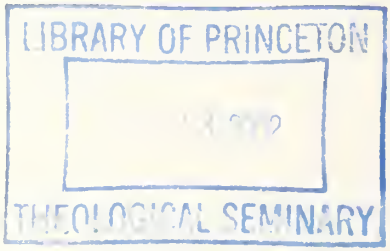

LIBRARY OF PRINCETON
THEOLOGICAL SEMINARY

Digitized by the Internet Archive
in 2016

https://archive.org/details/journalofasiatic111asia_0

THE

JOURNAL

OF

THE ASIATIC SOCIETY

OF

BENGAL.

VOL. I.

THE

JOURNAL

OF

THE ASIATIC SOCIETY

OF

BENGAL.

EDITED BY

JAMES PRINSEP, F. R. S.

SECRETARY OF THE PHYSICAL CLASS, ASIATIC SOCIETY.

VOL. I.

JANUARY TO DECEMBER,

1832.

"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science, in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta; it will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease."

SIR WM. JONES.

Calcutta:

PRINTED AT THE BAPTIST MISSION PRESS, CIRCULAR ROAD.

SOLD BY MESSRS. THACKER AND CO. ST. ANDREW'S LIBRARY.

1832.

TO

CAPTAIN JAMES D. HERBERT,

Bengal Infantry,

LATE

DEPUTY SURVEYOR GENERAL OF BENGAL, AND SUPERINTENDENT OF REVENUE SURVEYS;

AT PRESENT HOLDING THE APPOINTMENT OF

ASTRONOMER TO HIS MAJESTY

The King of Oude:

WHOSE JUDGMENT ORIGINATED; WHOSE PERSEVERANCE AND EXERTIONS SUCCESSFULLY ESTABLISHED; AND WHOSE SUPERIOR ABILITIES SUPPORTED FOR 3 YEARS,

THE FIRST JOURNAL

IN INDIA

DEVOTED TO THE EXCLUSIVE PUBLICATION

OF

GLEANINGS IN SCIENCE;

THIS VOLUME,

IN ALL RESPECTS, BUT TITLE, A CONTINUATION OF HIS OWN WORK,

IS

Inscribed,

BY HIS ATTACHED FRIEND,

THE EDITOR.

CALCUTTA,
January 1, 1833.

PREFACE.

The Asiatic Society, on the 7th March, 1832*, passed a resolution, that the monthly journal hitherto published under the name of "Gleanings in Science," should be permitted to assume that of Journal of the Asiatic Society, and to continue it as long as the publication remains under the charge of one or both of the Secretaries of the Society. This privilege has, as it was anticipated, been the means of extending very considerably its circulation, while it has given a character and authenticity to the work, by its connection with an institution of established literary reputation, which no anonymous magazine, however well conducted, could hope to command.

The advantages of extended circulation have reacted to the benefit of subscribers, by enabling the Editor to increase the quantity of letter press from 400 to nearly 600 pages; and yet so constant has been the growing support of its contributors, that the pages of the Journal have been devoted, with few exceptions, to the insertion of original communications.

To many readers it would doubtless have been preferable that the Journal should contain more copious extracts from English scientific periodicals, which are not procurable in the interior of India; but conceding that, as an organ of Indian scientific intelligence, it must obviously derive its only merit among the many similar periodicals of the present day, from its stores of *oriental* literary and physical research, it will be generally acknowledged, that the first object of the work should be to give publicity to such oriental matter as the antiquarian, the linguist, the traveller, and the naturalist may glean, in the ample field open to their industry in this part of the world. While acting

* The January number was not published until the middle of March.—Since then exertions have been made to bring up arrears, and in future each monthly number will appear with regularity on the 10th of the following month; the insertion of the meteorological register rendering an earlier issue impossible.

on this principle, however, the Editor has not lost sight of the great utility of following, as far as means would permit, the progress of the various sciences at home, especially such as are connected in any way with Asia; the only limits thereto being want of space, and want of time to peruse and extract from the vast number of publications of the present day. Want of room also precluded the possibility of republishing the proceedings of the Medical and of the Horticultural Societies; but this had become less urgent since both of those useful bodies adopted the excellent rule of giving early publicity to their own proceedings and records.

To the Asiatic Society THE JOURNAL has naturally looked for its most frequent and interesting communications; and in consequence of its more intimate connection with that Institution, the proceedings of that body have been given in greater detail than heretofore, so that absent members may learn exactly what passes at its meetings, and what accessions are made from time to time to its library and its museum. Many absent members have complained of the quarterly subscriptions they were heretofore called upon to pay, while they remained in ignorance of what was going forward; this source of objection is now obviated, and perhaps a still greater amendment may yet be effected for their benefit, by an arrangement that all-members of the Society shall receive a copy of the Journal gratis, which will reduce their annual payments nearly one fourth.

It is unnecessary to recapitulate the contents of the present volume, or to allude in anonymous praise to those who have favored its pages with their assistance; since the authors have, in most cases, on suggestion, permitted their writings to be authenticated by the insertion of their names, as should always be the case in matters of fact, observation, and research. One illustrious name however must not be passed over without a tribute of gratitude for its valued and frequent contributions, a tribute more sincerely paid, since India has now lost the power and the claim to their continuance; she has resigned her most eminent oriental scholar to climes where his talents may find more genial appreciation, but where they cannot excite more respect or admiration, than they will ever command in the land which called forth their energies and directed their application.

The learned Societies at home will be proud to publish the continuation of the *Analyses of the Purânas*, of which the four first have appeared in these pages. Abstracts of four only were ready for the press, but translations of the remainder of the eighteen *Purânas* themselves had been completed under the superintendence of Professor Wilson, before he quitted India.

Mr. Alexander Csoma's indefatigable labour, in opening to us a first acquaintance with the literature of Tibet, will be estimated as it deserves by literary men—a contracted circle perhaps, because deep erudition and study are requisite to form critics capable of appreciating the nature and bearing of his peculiar researches upon the history, languages, and religions of other nations, both ancient and modern. All may however feel sensible of the devotion, zeal, and perseverance, which are necessary to lead a man, alone and unpaid, into a distant and wild country, to learn its language, and study its people at the fountain head. The volumes of notes which Mr. Csoma has presented to the Asiatic Society, will, it is hoped, be published in their Researches at length.

In furtherance of the desire of the Government, the greater part of Dr. Buchanan's Statistics of Dinajpúr has been printed in a detached form, as commenced by the Editor of the GLEANINGS; and to complete the work more speedily, two extra numbers have been issued in the course of the year. It will be remarked, that there are many plates referred to in the text: the drawings alluded to are in possession of the Honorable Court of Directors, along with the original manuscripts; it was thought better to preserve the references, in case the Hon'ble Court might hereafter be persuaded to publish them, either in a separate form, or of a size adapted to the present edition. It must not be forgotten, that it is this undertaking which gained to the GLEANINGS the valuable privilege of free postage through the Bengal Presidency. The Editor is happy to announce, that the same boon has, in the most liberal manner, and without any solicitation, been extended to the Presidency of Bombay and to the Government of Ceylon, by their enlightened Governors, His Excellency the Earl of CLARE, and the Right Honorable Sir R. W. HORTON, to whom his thanks are thus publicly and respectfully addressed.

To his numerous correspondents, the Editor can but proffer thanks for past, and solicitations for future, support, bidding them remember that, the scope and object of this publication embraces the literature, the manners, the geography, physical and mineral, the arts, the natural productions of Asia, the phenomena of its climate, and observations of the heavens. In the words of the illustrious founder of the Asiatic Society, " the bounds of its investigation will be the geographical limits of Asia; and within these limits its inquiries will be extended to whatever is performed by man or produced by nature."

Dedicated, by permission, to

LADY W. C. BENTINCK,

A

TREATISE

ON

THE MUSIC OF HINDOOSTAN,

COMPRISING A DETAIL OF

THE ANCIENT THEORY

AND

MODERN PRACTICE.

THE similarity of the music of Egypt and Greece to that of this country has been traced and pointed out: harmony and melody have been compared: and time noticed. The varieties of song have been enumerated, and the character of each detailed: a brief account of the principal Musicians superadded, and the work concluded with a short alphabetical glossary of the most useful musical *Terms*.

BY

CAPTAIN N. WILLARD,

Commanding in the Service of H. H. the Nuwab of Banda.

Price to Subscribers, Sa. Rs. 8.

PROSPECTUS.

A TREATISE on the Music of Hindoostan was much wanted. The scanty information obtainable through the channels of Dr. GILCHRIST and Sir WILLIAM JONES, are neither of themselves sufficient to fill this chasm, nor do they elicit light sufficient to enable one to grope through the various obscure writings in the vernacular languages and dialects. The songs set to music by Mr. BIRD and Mr. WALKIER, are of the more modern style, and not of the ancient school; so that, instead of elucidating the theory, they lead us into confusion, when compared with the tables of Rags and Raginees given by Sir W. JONES.

The forthcoming work has been written with the view of describing in some measure, the theory and practice of the original music of Hindoostan, but chiefly to unfold the beauties of which it is susceptible. The extravagant eulogium offered to the music of ancient Greece, and the striking similarity which appeared to the author to exist between that and the subject to be treated of in this work, has led him to point them out, in the hope that, should a taste for the music of this country obtain among the professors of the science in Europe, it might perhaps conduce to the elucidation and revival of a much-desired and lost branch of knowledge, namely, the music of ancient Egypt and Greece.

For this purpose it appeared to the author, that a bare translation of any of the existing native works would not suffice. All who have been taught music are so much accustomed to the European way of explaining it, that every other must necessarily appear uncouth and preposterous. In the arrangement of this work, therefore, the European system has been adopted.

CONTENTS.

N. B. *The work will be printed on superior English paper, at the Baptist Mission Press, Calcutta.*

Subscriptions will be received by Mr. A. Jewell, Moorghehuttah, and Messrs. Thacker and Co. St. Andrew's Library.

CONTENTS.

No. I.—JANUARY.

No. 2.—FEBRUARY.

No. 3.—MARCH.

No. 4.—APRIL.

No. 5.—MAY.

No. 6.—JUNE.

No. 7.—JULY.

DIRECTIONS TO THE BINDER.

The sheets of Buchanan's Statistics are to be separated from the monthly numbers. The Plates may either be bound up at the end of the volume, or in the following order :

ERRATA.

Page 10 line 9 *for* "wool," *read* "wood."
—— 11 — 7 *from bottom, for* "plate 1, fig. 2," *read* "plate 2, fig. 1."
—— 14 *last line, for* "delomite," *read* "dolomite."
—— 19 — 16 *from bottom, for* "3, 4, 5," *read* "1, 2, 3, 4."
—— 20 — 8 *from top, for* "plate 1," *read* "plate 2."
—— 20 — 9 *for* "he protracted," *read* "the protracted."
—— — — 11 *for* "BB″ B′," *read* "B″ B′."
—— — — 16 *for* "intercepts," *rsad* "intersects."

AND

In Fig 2, plate II. continue the dotted arc 1′ 1 a'' to a'.
The line A c' continue to c.

—— 28 — 7 *from top, for* "manima," *read* "minima."
—— — *at bottom, for* "Artesien," *read* "Artesian."
—— 33 — 7 *for* "January," *read* "February."
—— 410 — — *in last column* of Table II. *for* "2m. 58s. 8," *read* "0m. 58s. 8."
—— 46 — 18 *from top, after* "which" *insert* "comma."
—— — — — ———————— "either" ditto.
—— 47 — 2 *from top, for* "have," *read* "has."
—— 57 — 12 *for* "$99\frac{1}{4}$ $99\frac{1}{2}$ $99\frac{3}{4}$," *read* "99^{1} 99^{2} 99^{3}."
—— 59 — 24 *and throughout the article, for* "sack," *read* "sac."
—— 60 — 4 "orbitar," *read* "orbital."
—— — — 10 "interval," *read* "internal."
—— — — 29 "lips," *read* "tips."
—— — — 34 *dele* "by."
—— 60 — 15 *for* "compressed and hard; before," *read* "compressed and hard before ;"
—— — — 28 *for* "lips," *read* "tips."
—— 62 — 11 *for* "this Chiru," *read* "the Chiru."
—— 63 — 10 *for* "bambdoidal," *read* "lambdoidal."
—— — — 14 *for* "malars," *read* "molars."
—— 65 — 8 *for* "$1\frac{1}{8}$," *read* "$\frac{9}{8}$."
—— 67 — 2 *from bottom, after* "than," *read* "the."
—— 74 — 15 *for* "9°," *read* "9h."
—— 75 — 21 *dele* "rufous," repeated.
—— 79 — 17 *from bottom, for* "done," *read* "donc."
—— 148 — — *foot note, for* "Rutboo," *read* "Kubboo."
—— 226 1st par. 5th line *for* "Ekadantashtra," *read* "Ekadanshtra,"
—— 226 4th „ 4th — *for* "Kridama," *read* "Srid'ama"
—— 229 2nd „ 5th — *for* "Vrishapati," *read* "Vrihaspati."
—— 231 — „ 3rd — *for* "Viswasé na" *read* "Viswakerma."
—— 238 — „ *after* "Ganges river," *insert* "at Gházipur."
—— 245 10 „ *from bottom, for* "it," *read* "the mirror."
—— — 1st „ 7th — *for* "He having," *read* "Having."
—— 296 line 3 *for* "but mostly," *read* "and,—"
—— — — 7 *for* "hydrogen. When," *read* "hydrogen, where."
—— 305 — 20 *for* "circumference," *read* "diameter."
—— — — 21 *for* "27½ rupees," *read* "2½ rupees."

Errata in Meteorological Register, for June.

Date	Hour.	Bar.		
13	Sun-rise,	*for*	,365	*read* ,465
14	,,		,399	,499
22	,,		,517	,617

Add 0,010 to all the figures in the Barometrical column for 10½ P. M.

—— 340 — 6 *after* "*Rhinolphus,*" *insert* "and two species of *Vespertilio.*"
—— 355 — 13 *for* "ακανσα," *read* "ακανστα."
—— 355 — 2 *from bottom, after* "*nílam,*" *insert* "*níl mani,* (or *manik.*)"
—— 356 *after* "College of Fort William," *insert* "the word *bahrmani* is also used in the *Khawás-ul* *'ár,* as a variety of the *yaqút.*"
—— 358 — 20 *dele* "or a species of garnet."
—— 358 — 22 *for* "*manik,*" *read lálri.*"
—— 403 — 5 *from bottom, for* "ΔΙΟΚΛΠ," *read* "ΔΙΟΚΛΗ."
—— 404 — 14 *for* ΟΥΑ," *read* "ΟΥΑ."
—— 411 — 8 *for* "Latitude 25° 43′," *read* "Lat. 25° 47′ 26″."

In Table IV. of the Estimate of Life in India, page 284, the first four figures in the second and third column should stand thus:

Age.	Survivors.	Deaths.
20	52221	473
21	51748	489
22	51259	522
23	50737	557

The mistake arose from the calculations having originally been made to commence with the age of nineteen, instead of twenty: and the 5 year averages in Table III. page 283, will all be slightly affected by the same cause. The last figure in the second column, page 284, should be reversed; and in the last column but one, *for* "2080," *read* "2008."

Line 414 line 3 *from below, for* "molluscæ," *read* "mollusca."
—— 444 — 36 *after* "ministry," *insert* "of a man."
—— 445 — 3 *from below, for* "2125," *read* "212.5."
—— 446 — 7 *for* "in bullion," *read* "bullion."
—— 447 — 21 *for* "will be," *read* "would be."
—— — — — *after* "at any," *insert* "rate."
—— 480 — 15-16 *for* "Tarîqa-i-Chishita," *read* "Tarîqa-i-Chishtía."
—— 483 — 36 *for* "lost about," *read* "tost about."
—— — — 39 *for* "Mújtahid-i-mústuqill," *read* "Mújtahid-i-mústaqill."
—— 485 — 20 *for* "Taqwiat-ul-Imám," *read* Taqwiat-ul-Imán."
—— 487 — 15 *erase* "5" at beginning of line.
—— 488 — 7 *for* "differences," *read* "difference."
—— 489 — 20 *for* "Káfr," *read* "Kufr."
—— 491 — 23-24 *for* Ishrák f'il Tasarraf," *read* "Ishrák f'il Tasarruf."
—— 492 — 10-11 *for* "the authority or influence of Saints, as respecting intercessors," *read* "respecting the authority or influence of Saints as intercessors."
—— 498 — 23 *for* "Khâtim," *read* "Khátima."
—— 501 — 12 *after* "A B C," *insert* "[fig. 5.]"
—— 505 — 20 *for* "5 53 59," *read* "5 52 59."
—— 506 — 11 *for* "5 53 10," *read* "5 53 27."

JOURNAL

OF

THE ASIATIC SOCIETY.

No. 11.—*November*, 1832.

I.—*Notice of the peculiar Tenets held by the followers of Syed Ahmed, taken chiefly from the "Sirát-úl-Mústaqím," a principal Treatise of that Sect, written by Moulaví Mahommed Ismaíl.*

The *Sirát-úl-Mústaqím*, or "The True Path," is the most important of several treatises which have been composed by followers of Syed Ahmed, the modern Mahommedan zealot and reformer, with whose name the European public has recently become familiar. It gives also the fullest account generally known of his tenets and pretensions. The interest attaching to his personal pretensions, has in a great measure ceased with his death, but the influence of his tenets still continues extensive, being understood, indeed, to have reached to almost all parts of India; and the subject is one which deserves attention, with reference to the marked distinction of opinions and usages which has arisen between those who have adopted his doctrines, and the mass of the Mahommedan population of the country. A subordinate portion only of this work is devoted to a statement of such opinions as affect points of common and obvious usage; but it is respecting these that curiosity may generally be supposed to exist. The main object of the author in composing it was, in the first instance probably, to shew his own learning; in the next, to justify the claims of Syed Ahmed, (of whom he was a constant and confidential adherent,) as a devotee, gifted with a surpassing degree of religious capacity and illumination. Its professed purpose is, kindly to impart to the world the benefits of the experience and inspired discoveries of a saint so eminent as Syed Ahmed was proclaimed to be, in those modes of religious exercise which are believed by the most orthodox Mahommedans to have an influence in purifying and strengthening the higher orders of human minds, which enables them, even in life, to attain to a

knowledge of the hidden meaning and essence of the institutes of their faith, to an intimate communion with the immediate presence of the Divinity, and to the most exalted state of spiritual dignity and power. The whole is written in a strain of what may most appropriately be termed Orthodox Súfíism. Touching but little on the metaphysical subtleties of the Súfí opinions, and utterly denouncing such of their professors as are not strict believers, it is still devoted to an exposition of many of the admitted Súfí tenets and practices, and is full of the technicalities of Súfí phraseology. It makes reference especially, in its explanations and allusions, to the peculiar divisions which prevail in India, among those who aspire to the honours of religious initiation. These are generally numbered as the followers of one or other of three venerated *Pírs*, each of whom has given a name to a distinct school or sect; the first, the "*Tarîqa-i-Qádiría*," which traces its origin to *Abdul Qádir** *Jílani*, of *Jilan*, or Ghilan. Another, the "*Tarîqa-i-Chishtía*," so called from its founder Khwája Múín-ud-dín Chishtí, whose tomb† is at Ajmere; the third, the "*Tarîqa-i-Nakshbandía*," derived from a Khwâja‡ Bahâ-ud-dín Nakshband, a native of Bokhára. It was one of the peculiar pretensions of Syed Ahmed, that he held himself privileged, instead of confining himself, as is usual, to giving admission to one only of these schools, to receive followers at his pleasure into any, or into all of them, and he aimed also at becoming the founder of a school of his own, to which he gave the appellation of the "*Tarîqa-i-Muhammedia.*"

It was not, however, to exercises of speculative piety, that this aspiring adventurer chiefly trusted to gain himself reputation and influence among his Mahommedan countrymen. The whole object of his career was to rouse and unite Mahommedan feeling in support of his own views of fanaticism and aggrandisement; and he naturally employed for that purpose methods more likely to have a generally active effect. The following sketch of the principal events of his career, and of the means by which he sought to obtain distinction, taken from the written or oral accounts generally current, may not be without interest, before proceeding to the detailed description of the peculiarities of belief and practice which his followers have adopted from him.

He began life in an indifferent school for the character of reformer and saint, which he ultimately assumed, as a suwar serving

* The name at full length, with all its titles, is Ghous-ul Azim Mahí-ud-dín Abdúl Qádir Jílaní. Born 471, Hijrí. Died 561, Hijrí.

† Died 633, Hijrí.

‡ Born 718, Hijrí. Died 791, Hijrí.

with Amír Khán's free-booting horse in Málwa. Quitting that service, about the time when the body of Amír Khán's followers was disbanded, he repaired to Delhí, and became a disciple of Shah Abdúl Azíz, a very celebrated devotee of the city; the fame of whose knowledge and piety has been widely extended throughout this side of India. It is frequently said by Natives, that it was from Sháh Abdúl Azíz, that Syed Ahmed derived the peculiar opinions which he subsequently promulgated, and the design which he adopted of preaching up a religious crusade. It is at least certain, that the chief of his first disciples, and the most constant associates of all his fortunes, were two near relatives of Abdúl Azíz, one his nephew, and the author of this work, named Moulaví Muhammed Ismaíl, the other his son-in law, and also partially a contributor to the book, named Moulaví Abdúl Hye. Of these persons, Muhammed Ismaíl is generally esteemed to have been a man of much talent and learning. The extreme honour which he and his brother Moulaví paid to Syed Ahmed, who was himself nearly illiterate, had a powerful effect in attracting towards him the respect of the vulgar. They rendered him almost menial offices, running, it is said, with their shoes off, by the side of his palankeen, when he moved out, like common servants. Attended by them, he set out from Delhí on his way to Calcutta, and thence on the sacred duty of a pilgrimage to Mecca. He chose a circuitous route for the purpose; for he is said to have first gone north to Seháranpúr, and then west with a sufficiently intelligible motive to Rámpúr; the jagheer held by the descendants of the Rohilla chief, Fyzúlla Khan, and the seat of a large body of turbulent Patháns. From his first leaving Delhí, he assumed the character of a religious teacher, and commenced spreading his reforming doctrines. The general spirit by which these were animated, (identical nearly with that of the tenets of the Arabian Wahabís, of whom the sect of Syed Ahmed may perhaps be accurately termed an Indian imitation,) was the ardent profession of Mahommedanism in its primitive simplicity and fervour, and the utter rejection of all idolatrous or superstitious innovations, whencesoever derived. It is obvious, that such tenets were well calculated to awaken the sincerity of religious zeal, and to gratify the pride of Mahommedan feeling; while, on the other hand, they were likely to meet with much opposition in the influence of long established customs and indulgencies. The manner in which they were at first actually received was however highly favourable. When Syed Ahmed at last came down to Bengal, he had got together many followers, and had established an extensive reputation. He arrived in Calcutta with a considerable

retinue towards the end of 1821, and immediately a great majority of the Mahommedans of the place, of all ranks and stations, flocked to become, or to profess themselves, his disciples. In the early part of 1822, he proceeded with his friends, the two Moulavís, to Mecca, from whence he returned in October of the next year, having touched for a few days at Bombay, where, with reference to the shortness of his stay, his success, in gaining numerous followers, was nearly as remarkable as in Calcutta. In December, 1823, he again started for Upper India. The next important event of his career, his commencing a religious war in the Lahore territories, did not occur till after a considerable interval, though the enterprise was one in which he had long openly announced his intention to engage. Its date is given in the following extract from the "*Targhíb-ul Jihád*," or "Incitement to Religious War," a little treatise written in Hindustaní during the continuance of the struggle, by a Moulaví of Kanouj, with the view, as its name purports, of rousing the Faithful to rally round the standard which had been raised in the Panjáb. "The tribe of Sikhs," says the indignant Moulaví, "have long held sway in Lahore and other places. Their oppressions have exceeded all limits. Thousands of Mahommedans they have unjustly killed, and on thousands have they heaped disgrace. The '*Azán*,' or summons to prayer, and the killing of cows, they have entirely prohibited*. When at length their insulting tyranny could no longer be borne, Hazrat Syed Ahmed, (may his fortunes and blessings be permanent!) having for his single object the protection of the faith, took with him a few true Mussulmáns, and going in the direction of Kabúl and Pesháwar, succeeded in rousing the Mahommedans of those countries from their slumber of indifference, and nerving their courage for action—Praise be to God—some thousands of believers became ready at his call to tread the path of God's service; and on the 20th Jummadi-úl-úla, 1242, Hijrí, (or the 21st December, 1826,) the Jihád against the Káfír Sikhs began." The events of this war were watched with a natural interest by the Mahommedan population of India generally, whether followers of Syed Ahmed or not. Many of the inhabitants of our Western Provinces went in bodies to range themselves under the

* This is a grievance of old standiug among the Mahommedans of the Lahore territory. Malcolm, speaking of the period when our army under Lord Lake pursued Holkar into the Punjáb, in 1805, says, "The Mahommedan inhabitants of the Punjab used to flock to the British camp, where they said they enjoyed luxuries which no man could appreciate, that had not suffered privation. They could pray aloud, and feast upon beef."

standard of the *Amír-ul Mominín*, or Leader of the Faithful, the title which he had now assumed to himself; and his emissaries gathered large contributions of money and jewels, even from our own distant Presidencies, and from the principal Mahommedan towns of the Dekhan. The prominent occurrences of the war, the perseverance with which it was kept up, the temporary and occasional successes which Syed Ahmed met with, and his ultimate death in battle, are well known. With his death, the struggle appears to have entirely ceased. That event, as was to be expected, is one which the people of his sect have been very reluctant to believe, and reports are still every now and then circulated among them, that he has been seen or heard of alive, and that the Sikhs are yet to have a rough waking from the dream, in which they are vainly indulging themselves, that they have got for ever rid of this inveterate antagonist.

But the notice of Syed Ahmed's personal fortunes has extended perhaps further than the subject merited. The account contained in the treatise, from which chiefly this paper has been compiled, of his rapid progress in spiritual illumination, deserves however to be adverted to, as affording a curious insight into the state of opinions among Mahommedans on such subjects at the present day; and an abstract of it will be given, in referring to the portions of the work which relate more especially to speculative or Súfí practices. The following string of questions, translated from a *risáleh* or tract, composed in refutation of Syed Ahmed's peculiar doctrines and pretensions, by an anonymous "*Fázilí Madrási*," or learned man of Madras, furnishes a convenient summary of the more important of them, and forms an appropriate introduction to the more lengthy statements of the Sirát-ul Mústaqím.

The questions are given with the short preface which precedes them in the original. "To the skilled in religion and law, these queries are submitted, in the hope that the perplexing doubts which have in this age seduced the more illiterate among the faithful into the thorny ways of error may by their sound explanations be removed, that right doctrine may be distinguished from deluding falsehood, and the actual relations and bearings of the truth, made clear to those now lost about and wandering in uncertainty."

Queries 1, 2, and 3. "Can any one properly lay claim to be the founder of a new and independent sect of law and morals, (to be a *Mújtahid-i-mústuqill)* after the time of the four chief Mújtahids, (the heads of the four legal sects, the Hanáfí, Málikí, Sháfií, and Hanbalí,) and before the appearance of the Imám Mehdí? Has any

one ever advanced such a claim? And, shall a claim of the kind now be recognized on the part of any one, who in these degenerate times, because he has picked up more or less knowledge of the ordinary books of commentaries and traditions, shall choose to set up a sect of his own, differing in a minute point or two from the four established ones? Is it too permitted to an uninformed person of any of those sects, to act on a tradition not recognized by his own sect, or by any of the sects?" (These three questions have reference to one of Syed Ahmed's opinions, which is asserted distinctly in the Sirát-ul Mústaqím, that it is improper to follow the authority of the four Mújtahids, or Imáms, where an opposing tradition* of the Prophet's precepts, or example, may be found of proved authenticity, and not subsequently rescinded. The established opinion is, that the mere fact of a tradition not having been received by one or other of the Imáms, shews it to be not authentic.)

Queries 4 and 5. "Is it proper to found a new sect, and school, (of Súfí, or enthusiastic devotion is meant,) and to give it the name of the Prophet of God, in the sense in which the appellation of "Múhammedía" has been given to the school of Syed Ahmed? and is it competent to any person not skilled in all branches of knowledge, external and spiritual, to claim to be a "Mujaddid," or Renovator of Religion? (This last claim was advanced by Syed Ahmed on the ground of a generally received tradition to the effect, that after every hundred years, God will send forth a person to renovate the faith. The objection to the term "Muhammedía," as it was used by Syed Ahmed, is, that it implied an almost exclusive claim to connection with the Prophet. Had "Múhammad" formed a part of his own name, it might have been employed by him without impropriety, to denote the connection of the school, or sect, with himself personally.)

Queries 6 and 7. "Is it lawful for a person to assume the title of "Amír-ul Mominín," or Leader of the Faithful, who holds no sovereignty, and cannot enforce his own orders? And what is the true meaning and application of the tradition which says, that he who does not recognize the Imám of his age, dies the death of ignorance, (that is, similar to that of the Arabs, in what was called their state of ignorance, or before the time of Mahommed); and is it absolutely binding on men to establish an Imám, or conditional only on their power to sup-

* Such traditions, which, after the Qoran, are the standard authorities on all questions of Mahommedan Religion or Law, are intended wherever the word is used here.

port him, and on the absence of opposing circumstances?" (These questions need no explanation, though the remark obviously occurs, that they suggest very convenient excuses for declining to give support to the enterprise of a mere fanatic adventurer.)

Queries 8 and 9. "Is it a violation of the Unity* of the Godhead to add to the true believer's profession of faith, "There is no God but God," the further declaration that "Mahommed is the prophet of God."

Is this giving a companion to God, or is it the very essence of the true faith? And is it unlawful to invoke the Prophet by the words, "Ya Rasúl Alla," or "Oh! Prophet of God." (These relate to branches of the Syed Ahmedí doctrine, of avoiding every thing which may bear the appearance of a departure from a pure belief in the Unity of God. It seems however questionable, whether the opinion implied in the first query is fairly imputed to the sect. Regarding the subject of the last question, the writer of the tract maintains, that to invoke the Prophet as an intercessor only is perfectly allowable. The point is not minutely dwelt upon in the Sirát-ul Mústaqím, but in another printed treatise, by the same author, in the Hindustání dialect, named the "*Taqwiat-ul-Imám*," the opinion animadverted upon is supported by a little refinement in argument. There is, it is admitted, nothing heretical in supposing, that departed Prophets and Saints may be able to *intercede*, but the faculty of hearing at the distance at which they are now removed from this nether world belongs to God alone.)

Queries 10 and 11. "Is it not lawful to make pilgrimage to the tombs of Prophets and Saints *(Ambiá wa Auliá)*, or of Mahommedans generally, repeating on such occasions texts and prayers from the Qoran, and avoiding what are notoriously abusive innovations? "And is the practice of performing the ceremony of the Fatiha in honor of the Prophet, of his companions, (the Sahába,) of Saints, or of any Mahommedan without distinction, by reading, at stated periods and anniversaries, sentences of the Qoran, and then conferring the blessing annexed to them, and to the food distributed at such times, on those exalted spirits—an innovation to be received as acceptable and praiseworthy, or is it to be rejected?"

(The practices here referred to are among the most obviously prominent of those in which the members of Syed Ahmed's sect have

* It is not easy to find any single English word which shall convey the meaning of "Ishrak" (إشراك), or the giving or attributing a companion to God. It has been rendered, as here, a violation of the Divine Unity throughout this paper.

departed from the general and deep-rooted usages of their Mahommedan brethren in India. Occasionally their pious zeal impels them to remove altogether such dangerous temptations to what they consider a violation of the Unity of the Godhead, as the tombs of Saints, by forcibly pulling them down. The word Fatiha, which denotes originally the first chapter of the Qoran, is commonly used to signify the whole ceremonies performed and prayers offered in behalf or in honour of the deceased, on the anniversary of their death or other fixed periods. Such ceremonies are observed in honour of relations or of any venerated Saint, and as practised by the vulgar, they go much beyond the simple form described in the queries. At celebrated shrines, they are kept up with great pomp and solemnity ; and what are mentioned in the queries as offerings, distributed for the benefit of the spirits of the Saints, are in reality ordinarily regarded as propitiations presented to secure their favour and protection. Saints are in effect commonly made direct objects of worship. Against the customary abuses of this ceremony, therefore, Syed Ahmed's instructions and denunciations were peculiarly directed ; long arguments, exposing their impious tendency and character, are contained in the Sirát-ul-Mústaqím, and they are a leading object of invective in all the writings of the sect. A good account of the ceremonies at shrines, with a notice of several of the most venerated Indian Saints, is to be found in the numbers of the Asiatic Journal for December, 1831, and January and February 1832, abridged from an article in the Journal Asiatique, on the peculiarities of Mahommedanism in India, by M. Garçin de Tassy.

Queries 12 and 13. " Is it unlawful, or unattended with reward or benefit, to repeat prayers sanctioned by the example of Mahommed *(Súnun)*, whether of fixed forms or numbers, or occasional and supererogatory prayers, when unobjectionable seasons are chosen for them ? And is any one privileged to prohibit the giving of blessings to Mahommed, (that is, the expression by men, of blessings upon him,) or repeating from books in which such blessings are set forth? (It appears from the answers to these queries, that Syed Ahmed denied that there was any excellence or virtue in the practices adverted to.)

Queries 14 to 18. " Have the leaders in the path of religious contemplation held it admissable to receive men indiscriminately as disciples into several of the Súfí schools at the same time, or to receive as a disciple one who has already adopted a religious instructor or guide, of a virtuous and pious character ; such instructor being living and present, and not having given his consent ? And is it not prohibited that any one, for his own corrupt and interested purposes, and

not possessing the requisite purity of heart and spirit, should deceive the vulgar with false stories of his soul having ascended into the heavens, and conversed with angels and the souls of the Prophets? Is not the using frauds in religion, and the turning the heads of the vulgar from the fixed and certain way, a thing of fatal consequence, and an obstruction to union with the Deity, (the mystical union with the divine Spirit is meant?) And is it proper or possible for any one justly to claim such an union with the Deity, who has abandoned the established rules and methods of the *Ahl-i-Sharíyat wa Taríqat*, the teachers both of the external institutes of religion, and of the more refined and contemplative devotion?" (These concluding queries refer exclusively to Syed Ahmed's pretensions to eminent success as a religious enthusiast and devotee, and sufficiently explain themselves.)

5. The Sirátul Mustaqím, which was composed before its hero, (as he may fairly enough be termed,) had proceeded with its author on pilgrimage to Mecca, and was printed in Calcutta during their absence at Mecca, by an active member of the sect, Moulaví Mohammed Alí of Rámpúr, discloses little or nothing of the designs which the party entertained of stirring up a war of religious fanaticism against the numerous infidels of India, though it breathes, in treating of the duty of religious war, a sigh of pious regret over the darkness which has in these later days overspread the land. Compare, it says, the state of Hindústán with that of Rúm and Túrán! Compare it even with its own condition two or three hundred years ago. Alas! where are now the *Oulía* and *Ulama* of those times? But the subject is only incidentally touched upon, and the part of the treatise which relates to external duties of piety and morality includes it in a very general review of those duties in all their branches. This review is contained in the second chapter of the treatise, where it is inserted to shew the preparation necessary before any real benefit can be gained by entering on the exercises of religious contemplation. The chapter is thus entitled, "On the avoiding innovations in religion, and the mode of performing acts of religious duty and worship; on the purifying of the heart from vices, and adorning it with virtues." In much of this chapter, there is nothing peculiar beyond the degree of extreme purity and fervent zeal, which is insisted upon as indispensable for an aspiring devotee, though it is expressly stated as being in excess of what is required for acceptance as a true Mahommedan. The denunciations against innovations are all that it is interesting to notice; and these, illustrated by more detailed explanations of the generally prevalent abuses

from other treatises, fully mark the puritan system of doctrines, which wherever it has been embraced, pointedly distinguishes the followers of Syed Ahmed from the bulk of the Mahommedan population. Scattered in comparatively small bodies, over numerous parts of the country, these people will probably be found to present everywhere nearly a uniform character, modified only by such broad traits of differences as exist between the natives of Bengal and those of Upper India. Mahommedanism, as it came pure from the lips, or was exemplified in the life, of the Prophet, was the aim and profession of the founder of the sect. Its members consider themselves the only true Mahommedans, and regard the faith and practices of their countrymen as little in advance of the idolatry of their Hindú neighbours. They guard themselves as separate communities, apart from the contagion of the ordinary superstitions; they refuse to join their nearest relatives in their most solemn and cherished ceremonies; they are arrogant, intolerant, ready to give offence by proclaiming their contempt for the commonly received opinions and prejudices, often, where they are strong enough, by open acts of turbulence and violence. Wherever they exist, more or less of irritation may be expected to arise between them and their brethren from whom they have separated; but being commonly very much the inferior party in numbers, they are likely to be kept down, or to get only noted and laughed at for their excessive and precise zeal, and the ignorant conceit, (the remark applies to the condition of the ordinary peasantry of the country,) which accompanies their pretensions as the professors of a reformed belief and worship. They will, at the same time, probably, deserve the credit of being strict and sincere in the performance of the prescribed exercises of their religion, and of having improved in many points of moral character, in consequence of their change of doctrine. All these circumstances, and the nature of the doctrines themselves, seem sufficiently to shew, that the sect is not calculated to be permanently popular, or to spread very generally and rapidly, unless under the impetus of some strong causes of excitement, of the occurrence of which there is now but little probability.

The innovations to be carefully shunned by every true Mahommedan are divided in the treatise under three classes. The first, those which have sprung from association with sceptics or heretics, and with those who sin against the Unity, and give companions to God, appearing like genuine Súfís*. The second, those which have been

* (ملحدین و مشرکین صوفی شعار متشبهین بصوفیهٔ کبار).

caused by association with Shías. The third, such as have had their origin in the imitation of bad and corrupt usages generally.

Among the abuses included within the first of these classes are the following. Excess of respect to Murshids, or religious instructors. The numerous innovating ceremonies, which have become generally observed at tombs; and the making offerings in honour of saints: abuses, which may be said to constitute, in practice, nearly the whole religion of the common Mahommedans of the country. These have almost universally their Murshids, to whom they pay implicit deference. To their venerated saints they apply in every difficulty, undertaking long and expensive pilgrimages to their shrines, and propitiating them by offerings and vows, to lend their aid in the attainment of every object of earthly desire—children, health, fortune, or honour. These innovations however may more accurately be ascribed to familiarity with the rites and customs of Hindúism, than to the influence of any Súfí speculations. The resemblance between a Mahommedan Murshid and a Hindú Gúrú, is obvious. In India (to adopt the phrase of the "Hidáyatul Mominín," also a Syed Ahmedí treatise,) more than in any other Mahommedan country, Islám and Káfr have been mixed like *khichrí!* "If the Hindús have their Gyah, their Mathura, and their Káshi, the Mahommedans have their Makwánpur, (where the tomb of the saint Madár is,) their Baraich, (where the holy Salár, or Salár Masúd Ghazí is buried,) and their Ajmír, (where the attraction is the well known tomb of Khwája Moyin-ud-dín Chishtí.) The one set build mat'hs over their idols: the other, not to be behindhand, raise domes over their saints' tombs. In the mat'hs, you will find Mahants and Gosains: at Mahommedan shrines, Khádims, Mujáwirs, and Pírzádas:"—the latter being a numerous and influential race, whose interests, fortunately perhaps, are directly opposed to the spread of the doctrines of these strict and sweeping sectaries.

The rule laid down in the Sirátul Mustaqím, respecting the reverence due to a religious instructor and guide, is, that it is quite proper to adopt such a person, and requisite indeed to those who desire to tread the path and obtain the rewards of contemplative devotion. But that he should not be so honoured as to be obeyed in preference to the orders of the Qorán and the Prophet. In indifferent things, his authority should be held paramount. "Follow no one," says the Taqwiatul Imán, "be he Mújtahid, Imám, Ghaus, Kutb;" (these two are appellations given to personages supposed to possess a certain high degree of spiritual power); "Moulaví, Mushaikh, King, Minister,

Padri, or Pandit, against the authority of the Qoran and the Traditions." These opinions are evidently connected with the pretensions which Syed Ahmed has been mentioned to have advanced of disregarding the authority of the four Mújtahids, whenever opposed to a tradition which might appear to be authentic, and never to have been rescinded.

Respecting the abuses prevalent in regard to the tombs of saints, and the offerings and honours paid to them, the Sirátul Mustaqim declares them to be endless—but selects a few for prominent reprehension. The subjoined is a concise abstract of the diffuse arguments and illustrations into which it enters on the subject. "First," it says, "the vulgar think it more of a sacred duty to make long and difficult pilgrimages from all quarters to the shrines of Saints, than to perform the pilgrimage to Mecca, though the end of all the trouble they impose on themselves, may be to run them into heresy and impiety, and by consequence to God's wrath. The performance of such pilgrimages may certainly yield a little benefit to the spiritual devotee, but it causes such excessive injury to Mahommedans in general, that all ought entirely to abandon it. Secondly; The asking favour and assistance from the Saints of the shrines, with a belief in their independent power, which is open blasphemy. Thirdly; The burning of lamps on tombs, which is actually believed to have the virtue of rendering prayers acceptable, though the practice is strictly prohibited in traditions of unquestionable authority; and all who are careful to choose that as the period for offering their prayers, if they have not ignorance for their excuse, are clearly Káfirs. As to the offerings made on behalf of Saints, as at the ceremony of Fátiha, their origin was good, and according to the law; but the grossest abuses have crept in upon them, varying from the lowest, which is, imposing on oneself as absolutely obligatory what is really not so, to the greatest, which is openly to sin against God's Unity. The devotions of the living doubtless confer benefits on the dead, but this may be done in two ways: One, by leading a life of general piety and goodness, by which alone the duty which men owe to God, the Prophet, their religious instructors, (all in the religious family, to the Saint, its first founder, are understood to be included,) and their natural parents will be fully fulfilled, and therefore a pious man may abandon the performance of Fátihas altogether. The other, by doing some specific virtuous act for the benefit of the departed. The ceremony of Fátiha belongs to this latter class, and if performed with the sincere desire and hope, assisted by prayer or not, that the reward of the

gifts distributed, may be conferred on the deceased, it is blameless; but then there must be no restriction as to times of distribution, kinds of food, modes of serving it, or the descriptions of persons who are to be privileged to share in it"—a condition, which at once strikes at the root of all that is thought most valuable in the usual practices of the Fátiha, and separates completely Syed Ahmed's followers from the ordinary community. It will be seen, how the doctrine tends to break up families, when one who has adopted it would refuse to join his brother in the ceremonies thought most binding in commemoration of their father's death. A variety of objections are urged against the propriety of the restrictions which are to be so entirely rejected. The sum and climax of all is, that the observance of them, replete with abuse as they are, has come to be considered as alone constituting the real essence of faith; that it is not *for* Saints, but *to* them that the offerings are regarded as being made; and that saints are therefore in reality worshipped, while God is neglected or forgotten.

Besides the going in pilgrimages to distant tombs, and observing the common ceremonies of the Fátiha, there are a variety of superstitious practices connected with those usages, and with the veneration paid to Saints generally, each of which is separately detailed, and its relinquishment *insisted upon* in the Taqwíatul Imán. The modes in which a pure belief in the Unity of God is departed from, are there classed under the four divisions of "Ishrák f'il Ilm, Ishrák f'il Tasarraf, Ishrák f'il Ibádat, Ishrák f'il Adat," or the assigning to God an associate or sharer in his Omniscience, in his exercise of the functions of Omnipotence, in the worship rendered to him, or the reverence shewn to him in any of those acts, among the practices of common life, which are indicative in any degree of sentiments of adoration or awe towards a superhuman power. Among the most popular practices springing from reverence for saints, which are denounced as belonging to one or other of those classes, are the applying to them for any particular desired blessing, as for children, &c. in the supposition, that their favour can, in a manner, reverse the order of fate—the dedicating in vows, and setting apart, animals to be sacrificed as offerings to them, or in honour of them, and the placing distinguishing marks upon animals for that purpose, which is declared to be an impiety, though even the orders of the law should be complied with by the "B'ism Illah" being repeated when the animal is actually killed—the making offerings of gratitude or propitiation to Saints after the birth of children—the giving to children names implying that they have been obtained through their favour; such as "Nabí Baksh," "Imám Baksh," "Madár Baksh,"

"Abdul Nabí," "Banda Alí," &c.—the allowing particular locks, or patches of the hair of children to grow untouched for certain periods, or the boring their noses or ears, as a mark of devotion to, or reliance for protection on, a Saint—generally the shewing the same signs of respect to Saints, as by standing up in repeating their names or invoking them, as to God himself—the making Sijda, or entire prostration to any one but God—and the making the "Tawwáf," i. e. a circuit or number of circuits, round the tombs of Saints, a ceremony to be performed round the holy Káába only.

The doctrine laid down in the Taqwíatul Imán, the authority or influence of Saints, as respecting intercessors is, that they may undoubtedly be privileged to intercede, but only when God has first granted them permission; and that the proper course is not to depend at all on their assistance, or to make any special prayer for their intercession, but to leave that, with all the other desires or necessities of man, to God alone, who, should such be requisite, will be careful both to provide an intercessor, and to give a sanction to his requests.

Of the second class of prevalent abuses, or those which have sprung from association with Shías, the first is an alleged departure from the established and orthodox belief respecting the relative superiority and precedence of the four first Caliphs, Alí being by many considered as possessing a higher degree of dignity and honour than his predecessors. This error is said to have in part arisen from the circumstance that most of the families or schools of religious devotees trace their origin up to Alí. The second abuse of this class consists in the ceremonies of the Moharram, which are observed as solemnly by very many of the common Súnís of the country, as by Shías. "A true believer," it is declared, "should regard the breaking a Tázia, by force, to be as virtuous an action as destroying idols. If he cannot break them himself, let him order others to do so. If this even be out of his power, let him at least detest and abhor them with his whole heart and soul."

Of the abuses which have sprung from bad and corrupt customs generally, those first marked for reprobation are the showy or expensive ceremonies on occasions of festivity and mourning—at marriages, and after the death of relatives. It is thought better, our author indignantly exclaims, that children should starve at home, than that these extravagancies should be abandoned. From such customs, a true Mahommedan should as far as possible keep free. He should labour indeed zealously to put a stop to them, reverting in such things to the orders of the Prophet, and the practice of his companions. "Fol-

low the example of Mohammed of Arabia," is the concluding direction in this part of the treatise, "and relinquish all the usages of Hind and Sind, of Fars, or of Rúm;" a comprehensive exhortation which gives in a few words the whole spirit of the reforming doctrines.

Another abuse of this class, attributed to intercourse with Hindús, is the prohibition of widows from a second marriage. "If there be a widow among your relations," (is the injunction on the subject,) "make her, if you can, marry a second time, whether she wishes it or not. Should she persist in refusing, relinquish all kindly intercourse with her—Shrink not, should you in this depart from the fixed customs of your ancestors; God has a higher claim upon you than they." It should be mentioned, however, that it is not known how far this injunction is at present respected, or at least practically acted upon, by the members of the sect generally.

Of the further abuses, referrible to this last division, there may also be mentioned, from either the Sirátul Mustaqim, or the Taqwíatul Imán, the vain glorious relying on the good qualities of pious ancestors, which is noted as the special sin of Syeds and Pírzádas—the placing faith in the practices of astrology or soothsaying in any shape, or in omens or Fáls from the Qoran—the attending to lucky or unlucky days—the worshipping, like the Hindús, their goddess of the small-pox, Sítalá, or even [a curious excess of enthusiasm] the adopting the infidel custom of keeping children from going near others who have the small-pox—the keeping pictures of the Prophet or of Pirs—the swearing by any one but God—the using the words Málik and Banda to express the relation between master and slave—besides which are enumerated very many others, defying any concise enumeration, against each of which the Taqwíatul Imán arrays a battery of texts from the Qoran and traditions, made accessible to all readers by translations and comments in the plainest Hindústaní.

The above comprises as complete a sketch of the peculiar opinions of the sect of Syed Ahmed, in all matters of external worship and morals, as has been found immediately procurable from information and books to be obtained in Calcutta, and presents doubtless a sufficiently accurate outline of them. The effect which they must have in separating their professors as distinct communities will be obvious on the mere perusal of them—for they may be literally said to affect every important event in which men can be concerned from their cradle to their grave.

It is to be remarked, as a new feature in the history of efforts for the propagation of Mahommedanism, or for the reform of its corruptions, how extensively the emissaries of this sect have availed themselves of the press to disseminate their tenets. The Sirátul Mustaqím, the Taqwíatul Imán, the Hidáyatul Mominín, and a little tract attached to it, named the "*Múzihul Kubair wa'l Bidaát*," and two other tracts, entitled the "*Nasíhatul Muslimín*" and "*Tambíhul Gháfilín**," have all been printed at private presses in Calcutta or at Hooghly.

The pretensions of Syed Ahmed as a holy Súfi devotee, and his system of enthusiastic discipline and devotion, remain to be adverted to—but any thing beyond a very cursory notice of them would be tedious. A few words will explain all that appears to be peculiar in the system, and the details here given do not therefore extend beyond the account which has been stated to be contained in the Sirátul Mustaqím, of the rapid progress of this apt scholar in the paths of spiritual knowledge. With this branch of his opinions and instructions, it is to be supposed, that the great mass of his followers have but little, if any, minute acquaintance.

It has been mentioned, that the author utterly denounces the infidelities, which have attended the more refined and metaphysical speculations of numerous Súfí professors. This denunciation is to the following púrport. "Among the greatest obstructions of the path to God are infidel or heretic pretenders to Súfiism (Mulhidín i Súfí Shïár), who so far from fearing to violate the commands of the law, make the doing so their habit and characteristic—who teach and learn detestable, innovating, impious exercises or practices—and propagate infidelity (Ilhád) in the world; Let such be dealt with according to their deeds. Let those who deserve death, be put to death; and let those who merit the other grades of punishment (Tázírwa Tambíh) receive them. If it be not in your power to enforce the orders of the law, look on such persons with loathing, and regard the very sight of them as an abomination."—On the question of the identity of God and matter—an opinion very prevalent among Súfís—it is declared, that the point is one which it is worse than useless to be constantly discussing, but that what has been said respecting it by the illustrious authorities of Súfiism—the Akábr i Taríqat—does not go beyond

* Since this paper went to Press, the writer has seen another Treatise printed in the course of last year, the *Miáyatul Masáil*, or the hundred questions: being answers by Shèkh Mohammed Ishak, a grandson of Shah Abdúl Azíz, to queries stated to have been put to him by some of the Royal family at Delhi.

this, that created things are not to be considered as actually one with the Deity (*eyn i haqq*), though they have their stability and permanence in him, and are the *muzahir i sifát*, the media in which he has chosen to manifest his qualities.

The foundation of spiritual progress in the school of Syed Ahmed, as with Súfis generally, is an entire abstraction from personal or worldly reflections and interests, and an ardent and unceasing adoration of, and love for, the Deity. But it is held to be important to distinguish between two kinds of love, of which our nature is capable, and which are of separate characters, though, with a true saint, like Syed Ahmed, they may exist, and be cultivated in full vigour together; and the difference between these and the relative value of the two are stated to have been too much lost sight of, especially in these later days. The one designated *hubbi ïshki*, has its origin in feeling and passion, in the longing of the soul to rejoin its divine source; the other, termed *hubbi imáni* or *hubbi aqli*, (to which an indirect preference is given,) springs from the intense admiration and affection, with which it is inherent in the constitution of man's reason and perceptions, that he should regard a Being possessing all the qualities of beneficence, power, and infinite perfection, which are combined in God. Of the former love, the aim and reward are a certain mystical absorption in or junction with the Deity, accompanied by the highest degrees of spiritual knowledge and dignity. Of the latter, the result is an entire devotion of thought and purpose to the service of God, which is recompensed by its possessor being employed as an inspired and prominent instrument for working the divine will, or promulgating the divine commands, in the world. The former is declared to have been the special state and ornament of the Oulía or saints, and the exercises by which it is to be perfected are therefore termed the *ráhi wiláyat;* the latter was the peculiar attribute of the various Ambia, or prophets and messengers to man, and the modes of acquiring and strengthening it, to the degree to which it can now be carried, are termed the *ráhi nabúwat.*

So much of introduction explanatory of the nature of these fanciful opinions has been necessary to render intelligible the following abstract of the history of Syed Ahmed's progress towards the perfection of the saintly character. It will seem strange, that such wild delusions should ever have received* acceptance, which it must be sup-

* It is not known, that the Sirátul Mústaqím, though printed, has any extensive circulation. The pretensions which it puts forward for Syed Ahmed, are however, the same as those which he actually advanced for himself, and on which

posed that they in some degree did from the reputation which this fanatic generally acquired. The aim of the whole to serve his object of establishing a claim to a high mission, and attracting followers, is very obvious; but the familiarity with which his alleged intercourse with the Deity is spoken of would, to our notions, indicate rather a near approach to irreverence than the excess of devotional awe, which is inculcated throughout this treatise. The names which occur of the three Súfi schools, the Kadiría, the Chishtía, and Nakshbandía, have been already explained.

" Let it be known," says Mohammed Ismael, " that all the perfections of the *Tariq i nabúwat* were implanted from his birth in the nature of this holy man, as evidenced by the delight which he took in the exercises of piety, and practice of virtue from his childhood. At length, when he was admitted into the society of the venerated Shèkh Abdúl Azíz, (who received him as a disciple into the Nakshbandia school,) by the propitious effects and influence* of the enlightened spirit of his instructor, the concealed excellencies of his nature developed themselves in a rapid succession of wonders. Of these, the first was that he saw the Prophet himself in a dream, who fed him with three dates in succession, which circumstance he knew to be true by the effect which he found to be remaining (on his palate, it is to be supposed) when he awoke. This was the commencement of his progress in the Tariq i nabúwat. A further eminent advance in it was gained by him from the following event: In another dream, he saw the sainted Alí and the holy daughter of the Prophet, Fátima—when the former bathed him with his own sacred hands, and washed him carefully, as parents wash their children, and the latter clothed him in garments of exceeding richness. On this the favour and acceptance, which had been set apart for him from eternity, became directly visible, and he was taken under the

he founded his claim as the head of a new school and sect. The genealogical tree of his religious family, a copy of which, like other religious teachers, he consigned to each of his disciples, contains statements of his communications with the Deity and with the spirits of saints, similar to those of the passage here translated. It gives also the names of the different Pírs of each religious stock in which he professed initiation, up to their respective founders: his claims being thus of two kinds, one of direct communication from the spirits of the several saints, the other of initiation in the ordinary mode.

* The words are " *Barakat i tawajjúhát.*" " Tawajjúh" is used in the passage in a technical Súfí meaning, implying the devotion by a teacher of all the contemplative powers of his mind to the object of communicating his own illumination to his disciple, which it is supposed that he has the faculty of doing.

immediate guidance and guardianship of God. One wonder followed upon another, till one day the Deity taking his right-hand with his own arm of power, and placing before him some of the rare treasures of heaven, said to him, 'This I have given to you, and I shall give you yet more.' About this time, some one entreated urgently to be received by him as a religious disciple; when he put off giving a final answer for a few days, and in the interim, applied with the eye of contemplation to God, saying, 'You have taken my hand, which whoever in this world does*, attends always to the obligation thereby assumed, and what relation can the virtues of mortals bear to the qualities of God? What course then is it your will that I should follow towards this man who desires to adopt me as his religious guide?' The reply from God to this application was, 'Should thousands and thousands seek to be your followers, I shall provide for (or be sufficient to) them all.' And in this way event crowded on event with him, and fresh miracle upon miracle, till he reached the ultimate perfection of the Tariq i nabúwat, and attained to inspired knowledge.

Next as to the Tariq i wiláyat—respecting this it is to be understood, that the modes of exercise and contemplation followed in each of the separate schools lead to a certain peculiar capacity of connection in the spirit of the devotee with the Deity, which ordinarily is not acquired till after all those preparations have been gone through. But occasionally with some higher or more favoured spirits, this capacity precedes any use of preparatory discipline. So it was with Syed Ahmed. In the Kádiría and Nakshbandía schools, it was gained in a few hours, and directly from communication by the spirits of the founders of those schools—they having contended for nearly a month with each other for the exclusive possession of him, and having in the end agreed to descend upon him together. In the Chishtía school, its acquisition was commenced by communication from the spirit of the revered Kútbul aktáb Khwaja† Bakhtiár Káki; when Syed Ahmed was sitting in contemplation on the tomb of that saint, and it was afterwards perfected by communication from God himself. This happened to him in the Akberábádí Masjíd at Delhi, when he was engaged in devout contemplation with a number of his followers, among whom the writer,

* The form is that by which a Murshid, or religious guide, receives the adherence of his followers.

† He was a celebrated Saint of the school.

Mohammed Ismael, himself was. When the assembly had broken up, he told the writer what had occurred in the course of it, viz. that God had himself vouchsafed directly to complete what had remained imperfect in his knowledge in the Chishtía school. From that time he began giving instructions in that school also, and introduced of himself the new and more expeditious method of performing its exercises, which has been described in this treatise."

The above is a sufficient specimen of the extravagances of enthusiasm or imposture which pervade the book. What is claimed as the peculiarity of the system which it explains, consisting of the distinction drawn between the two kinds of love towards the Deity, by which a devotee may be actuated, and of the grades of spiritual distinction to which they severally lead, much of it is occupied by expositions and illustrations of the grounds on which that distinction rests. These form the subject of the first chapter. The second chapter treats of the religious and moral duties and observances, the exercise of which prepares the devotee for spiritual contemplation. The third relates to the modes of contemplation prescribed by Syed Ahmed, for attaining to the perfections of the Tariq í wiláyat, with reference to the peculiarities of each of the several prevalent schools, and contains much which might be thought curious, could its technical details be brought within any short compass. The fourth describes the process of acquiring the excellencies of the Tariq í nabúwat, and a *Khátim* or conclusion sets forth the wonders experienced by Syed Ahmed himself, in the passage which has just been translated.

It has only to be added, that the treatise professes to have been written throughout, though not under the dictation, yet under the immediate eye and revision of Syed Ahmed. He, it is stated, having been endowed with a nature resembling in all respects that of the Prophet himself, was unacquainted with the forms and technicalities of worldly science. So that, to render the subject intelligible to general readers, his sayings and lessons have not been given exactly as he uttered them, but have been explained and arranged by the author according to the ordinarily understood rules of composition. The whole however was carefully read over to, and corrected by, him before being given to the world.

J. R. C.

Trisection of Angles.

fig. 1

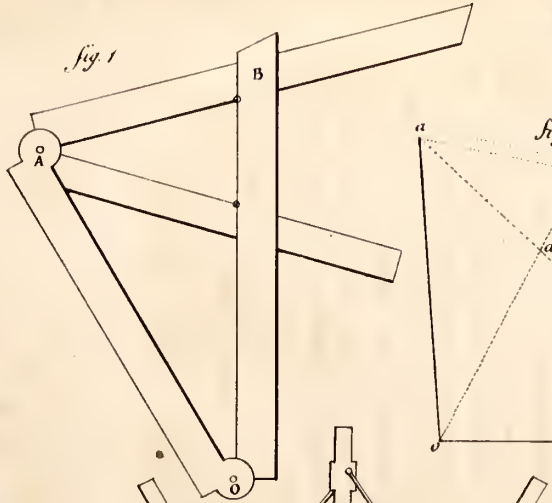


fig. 2.

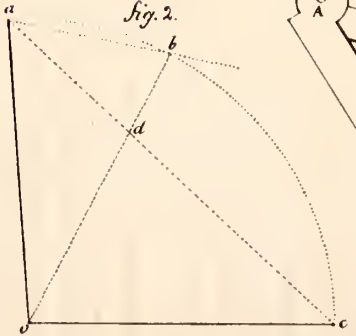


fig. 3

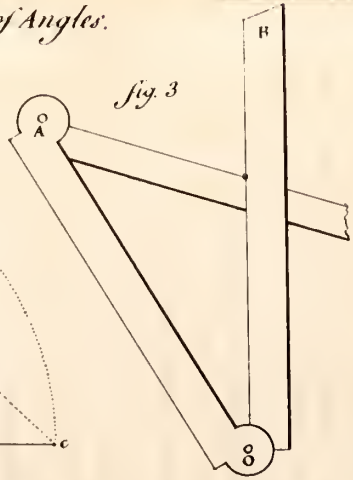


fig. 4

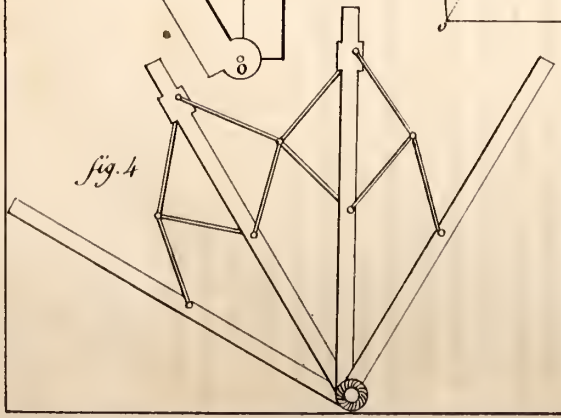


fig. 5

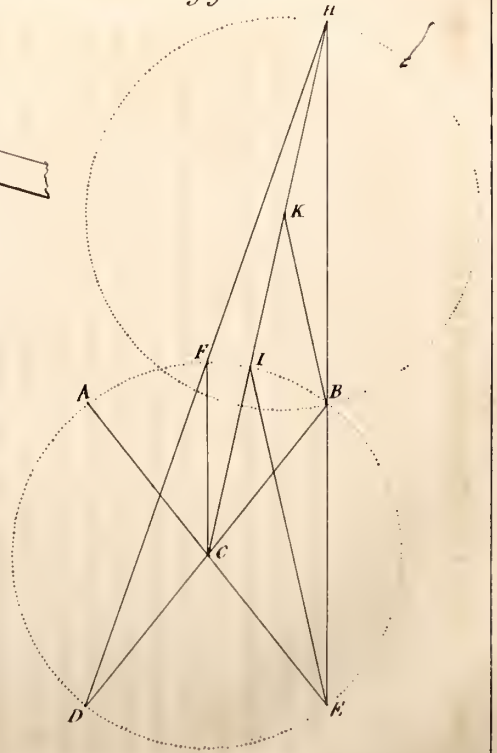
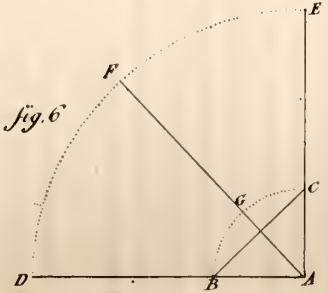


fig. 6



II.—*Description of an Instrument for trisecting Angles.* By *Lieut.* T. S. Burt, *Engineers.*

I have the pleasure of sending you, for insertion in the Asiatic Journal, a description of an instrument I have lately made for trisecting any plane angle, which I should not probably have been induced to trouble you with, had I not seen, in the United Service Journal, for January last, an account of Captain Burton's problems for effecting the trisection, but they are all, you will have perceived, founded on trials, which in these cases are not allowed: and also, in the same volume, Major Mitchell's problem; but his attempt is very easily disproved, notwithstanding the confidence with which he gives it forth, as the true mode of trisecting an acute angle, which it is well known cannot be effected geometrically, and which, moreover, has been proved to be impossible.

Description. The accompanying Plate XII. fig. 1, exhibits a sketch of the instrument or trisector, which consists of four pieces of brass connected together at, but moveable on the points A and O. The leg or piece, A B, passing through a groove or opening at the extremity of the leg O B, in order that it may allow of O B being slided at B, over and along its length. The piece A D is made rather thinner than the others to admit of its passing underneath O B, whenever O B is made to slide along the leg A B towards A, as above noticed. A D is moveable on the point A.

This instrument will trisect any angle from 1° to 180°, and the correctness of its principle is evident from the annexed diagram, (fig. 2.) It may not seem irrelevant to remark, that No. 22, volume I. of the Mechanic's Magazine, contains the description of an instrument for performing a similar operation, invented in the year 1824; but that machine contains, of necessity, no less than 14 pieces, (see note at the end of this statement,) and its principle of construction is quite different from that of this instrument, which, as above stated, consists of only four pieces, and may, as I shall hereafter shew, be reduced to three.

Application. Let *a o c*, fig. 2, be *any* angle required to be trisected. Draw the chord *a c*, and lay the leg of the trisector, A O, upon one side *a o* of the angle, so that the point A of the instrument may coincide with the point *a* of the given angle, and O with *o*, respectively. Next, place the leg A D, which, as before described, is moveable on the point A, along the chord *a c*, without paying any regard to the length of this chord, until the leg and the chord coincide. Then slide the leg

O B, which is also moveable on the point O, until A D becomes equal to A B; this can be easily effected, (because A D & A B have each a scale of equal parts (of degrees) attached to them, commencing from A.) The given angle *a o c* is now trisected, and A O B is the third part of it.

Proof. The two triangles *a o b*, *a b d*, are equiangular, for the angle *a b d* is common to both triangles, as well as equal, both to the angle *b a o*, (because rad. *b o* = rad. *a o*,) and to the angle *b d a*, (because *a b* = *a d*, by construction or application of the instrument.) The two triangles, having 2 angles in the one, equal to two angles in the other, have therefore their third angles equal, namely, the angle *a o b* = angle *b a d*. But the angle *b a d*, at the circumference of the circle *a b c*, being measured by half the arc it stands upon, *b c*, is half of the angle *b o c*, at the centre of the same circle, measured by the whole arc *b c*; therefore, the angle *a o b*, its equal, is half of the same angle *b o c*, or one-third of the whole angle *a o c*, which was to be trisected.

The legs of the instrument may be reduced, in number, to three, thus —The piece A B is absolutely necessary to the first construction, in order to affix a scale of equal parts to A D, similar to that upon A B, (one of degrees is the best, because the angle can then be read off, not forgetting, in dividing it, that A D is to be considered the *chord* of an arc; but as soon as the parallels have been cut upon both legs, A B becomes superfluous.

To show this, I will state how A D is divided;—1st, set off upon A B a scale of equal parts, making their productions pass through the centre O, at whatever position of the instrument, but governed by O B. 2dly, when these have been cut upon the leg A B, set off an equal scale upon the other leg A D, and make their productions pass through the corresponding lines upon A B, conveying to the centre O likewise.

This being done, it must be evident, that the subsequent use of A B is superfluous, because the leg O B, after it has been placed parallel to, that is, immediately over and upon, any line that has been cut upon A D, and that was made by construction, to pass through corresponding parallels on the leg A B, no longer requires, for this very reason, the aid of the latter piece; so that the trisector, in this state, will, as before mentioned, consist of only three pieces, (as shewn in fig. 3.) But, in this case, having applied A O and A D, as before, to the side and chord of the angle to be trisected, O B must be moved towards A, until O B become parallel to, or coincide with one of these

lines of equal parts, which are cut upon the piece A D, and then the given angle will be trisected.

Note.—Fig. 4 is a sketch of the instrument above alluded to : it is copied from the 1st volume of the Mechanic's Magazine.

III.—*On the Trisection of Angles. By Mr.* W. Masters, *Verulam Academy.*

In one of the late numbers of the United Service Journal, there is an article on the trisection of an angle, written by a Major in the British Army, resident at New South Wales. This gentleman believes he has solved the problem, and demonstrated his solution, which is in substance as follows :

Let A B C be the angle to be trisected ; from C as a centre, and with any radius C B describe a circle; produce A C, B C, to E and D ; join E B ; trisect the arc A B in F ; join C F and D F, and produce the line D F, till it meets the line E B produced in H ; join C H ; C H cuts the arc A B in I ; the arc B I is one-third of the arc A B : this is his solution of the problem. In the demonstration, he proceeds to say, take B K=B C, and from the centre K, with the radius K B, describe a circle, &c. &c. The demonstration appears to be complete, and the gentleman exults at his success ; but it escapes his sagacity, that his demonstration is built upon the hypothesis, that the circle K passes through the point H. Now, this is a very important point ; the whole solution depends upon it : it is obtained by the intersection of the lines E B and D F produced. My object is to prove, that the *locus* of the point of intersection, of the two lines E B and D F, is not the circumference of a circle, which passes through B, and whose radius B K is equal to B C.

If possible, let the point H be in the circumference of the circle K, described as stated above.

$$\therefore B K = K H = B C = C D.$$
$$\therefore B K + K H = B C + C D = B D \text{ ; but}$$
$$B K + K H > B H \therefore B D > B H. \text{ Again}$$
$$\angle E B D = B H D + B D H \text{ and}$$
$$E B D = B C F, \text{ because } E H \parallel C F,$$
$$\therefore B C F = B H D + B D H \text{ ; but}$$
$$B C F = \checkmark B D F \therefore B D H = B H D$$

$\therefore$ B D = B H, and it has been proved to be greater, which is absurd. Therefore the point of intersection of E B and D F is not in the circumference of the circle K, and *therefore*, a line, H C, drawn from this point to the centre C, does not cut off a third part B I of the arc A B ; because

If B I be a third part of the arc A B, the locus of the intersection of C I with E B is the circumference of a circle passing through B, whose radius B K is equal to B C.

Let B C I be the one-third of B C A, and let C I and E B produced meet any where in H ; (it is easy to prove, that they will meet in that direction :) join E I, and through B draw B K $\parallel$ to E I.

$\angle$ C K B = C I E = C E I = $\frac{1}{2}$ A C I = I C B $\therefore$ B C = B K.

Again $\angle$C K B = K C B = 2 I E B = 2 K B H ; but

$\angle$C K B = K B H + K H B $\therefore$ K B H = K H B $\therefore$ K H = K B, and $\therefore$ K is the centre of a circle passing through H and B, and having its radius B K = to B C.

The Major, therefore, has not trisected the angle : I believe, the problem remains just as it was before the Major took it in hand.

I hope I may be allowed to correct an error, relating to the present subject, into which many fall, who have not leisure to *examine* geometrical theories, &c., but yet have occasion to employ them. To trisect an angle, they are directed by some treatises, (Adam's Geometrical Essays, I believe, is one,) to find an arc that is equal to the third part of the given arc, and to *lay it off* on the given arc ; and a cumbersome mode is taught of finding this required arc, which is easily obtained thus :

Let D A F be the given angle ; take A D = any length = 3 (for instance) ; and take A B = $\frac{1}{3}$ A D = 1, and describe the circles D F E, B G C; then according to Newton's 5th lemma, A B : A D : : arc B G : arc B F $\therefore$ arc B G = $\frac{1}{3}$ arc D F. Now the difficulty is to *lay off* the *arc* B G upon the *arc* D F, so as to divide D F into three equal arcs. Recourse is had to a pair of compasses ; but it is very plain, that the compasses measure only the *chord* of B G, which is a *straight line*, and not the *arc* itself, which is a *curve*. Let the right angle D A E be trisected after this manner, and it will be found, that the chord B C will not answer the purpose. If it do, each portion of the arc being equal to 30°, B C = $\sqrt{2}$ = 1.41, &c. will be the chord of 30° ; whereas the chord of 30° to the radius 3 is equal to 1.55, &c.

V.—*Note on Indian Saline Deposits. By Mr.* Henry Harpur Spry, *Bengal Medical Service.*

[Read 3rd October.]

In the fourth number of the Journal of the Asiatic Society, a note was published by the Rev. R. Everest on Indian saline deposits, in which particular attention was directed by that gentleman to the large quantities of *carbonate* of soda found in a plain about a mile to the west of Ghazípúr. He states also, that " As the sulphate of soda, is said to be collected in large quantities, from the soil of the basaltic districts on the western side of India, it is not improbable, that these saline deposits are distributed over the peninsula of India coextensively with the nodules of *kankar* (corbonate of lime), and hydrated iron ore."

I have never met with any saline deposits among the trap formations of this district; but I am induced to believe the following notice regarding the sulphate of soda deposit in the Gangetic portion of the Oude territory, contiguous to Cawnpore, may not be unacceptable.

This saline deposit abounds in very large quantities about Unaú, and is found in the ravines all the way on to Sultanpur. It has a light earthy, and sometimes a dirty white, appearance in the mass, and its fracture is brittle. It yields by the common native process full 50 per cent. of pure Glauber's salt, of which quantities are annually manufactured by them; and on analysis I found 200 parts to contain of

Dried Sulphate of soda, ...	145.9
Muriate of soda, ...	6.0
Alumina, ...	25.0
Trace of iron, ...	1.5
Silicious sand, ...	9.0
Trace of lime, ...	1.0
Loss, ...	12.0
	200.4

The *kankar* formation is very abundant along the Cawnpore bank of the Ganges, but the new sandstone formation of Bundelkhand, (which is the nearest approach I am aware of,) must be further, even from the sulphate of soda deposit of Unaú, than the Ghazipúr saline deposit described by the Rev. R. Everest.

Ságar, Aug. 14, 1832.

VI.—*Eclipses of Jupiter's Satellites.*

[Observed at *Chuprah*, Lat. 25° 47′ 26″ N., Long. 5h. 39m. 7s. E. by Mr. Walter Ewer.]

		Mean Time.		Difference from Greenwich.
		h. m. s.		
2nd October,	Emersion of Sat. II. at	7 57 56.3	very clear.	5 39 04.3
3rd Ditto,	Emersion of Sat. I. at	9 53 50	ditto.	5 39 12
19th Ditto,	Ditto at	8 13 32	ditto.	5 39 02

Troughton's 5 feet achromatic, power about 200, aperture 3.8 inches. This telescope has been 25 years in the country, and is in excellent order.

Observations in Calcutta.

19*th October*, 1832.—On this day by the Ephemeris the whole of Jupiter's satellites were to be eclipsed, and of the phenomena no less than four out of six, viz. two immersions and two emersions, should have been visible at Calcutta. The weather having been unusually fine and clear for some days past, it was thought to be a good opportunity for trying the power of the superb reflecting telescope, lately presented to Mr. James Calder, by Sir John Herschell:—one of the last made under his father's directions. The following gentlemen undertook to make simultaneous observations with their own telescopes, by way of ascertaining the extent of uncertainty in the use of different instruments under precisely similar circumstances: Captain D. Ross, Marine Surveyor General, at his residence in Chowringhee, and his assistant Lieut. Lloyd, with a second telescope at the same place; Captain Wilcox, Mr. Logan, and Lieutenant Waugh, at the Surveyor General's office, in Park Street; Mr. H. Barrow, H. C. Mathematical instrument maker, in Loudon Street, Chowringhee; and Mr. Gray, at his observatory in Garstin's Buildings; while Lieut. Pemberton with his own telescope, Mr. Gordon with his, and myself at the large reflector, should make the observation at Mr. Calder's residence in Esplanade-row.

The evening proved hazy, and it was only at intervals that Jupiter could be seen to advantage; still, however, with all three telescopes, and particularly with the large reflector, the belts and satellites were distinctly visible through the haze. The immersion of the fourth satellite expected at 8h. 17m. 30s. was not visible on account of the mist—indeed the satellite had disappeared several minutes previously, or when we first stationed ourselves at our glasses. The emersion of the same at 11h. 3m. 20s. and the immersion of the third at 16h. 48m. 9s. were likewise lost from the same cause; so that the emersion of the first satellite, was the only one we were fortunate enough to obtain. The sky too was less hazy at that moment, and the belts were distinctly

marked : still the observation was under unfavourable circumstances, and affords results applicable only to such. To save trouble all the observations have been reduced to the same meridian, namely, that of the Ochterlony monument, by applying—2 sec. to those of the Surveyor Genl. Capt. Ross, and Mr. Barrow, and + 1 sec. to those of Mr. Gray: during the remainder of the month other observations were made in a similar manner :—they have been reduced to the same meridian, and the telescopes used are distinguished by letters of reference. P.

19*th October*.—Emersion of Jupiter's first satellite, Calcutta.

Observer.	*Telescope.*	*Aperture.*	*Power.*	*Note.*	*Obs. Me. Ti.*	*Longitude.*
Prinsep, *a.*	ten-foot reflector	9 in.	160	hazy	8 27 58	5 53 28
Pemberton, *b.*	four-foot achrom.	3.7	110	do.	8 27 59	5 53 29
Gray, *c.*	42 in. achromatic,	2.7	80	do.	8 28 12	5 53 42
Logan, *c.*	42 in. ditto, ...	2.7	80	do.	8 28 05	5 53 35
Ross, *c.*	42 in. ditto, ...	2.7	80	dull glass	8 28 37	5 54 07

26*th October*.—Emersion of I Sat. observed in Calcutta.

At the Surv. Gen.'s,	Wilcox, *c.* [42. in. 2.7 ap. 80 p.]	10 23 15	5 53 05
	Waugh, *c.*	10 23 41	5 53 31
	Logan, *c.*	10 23 25	5 53 15
At Mr. Calder's,	Pemberton, *b.* [4 ft. achr.]	10 24 09	5 53 59
	Prinsep, *a.* [10 ft. ref.]	10 24 09	
At Mr. Gray's,	Gray, *c.*	10 24 01	5 53 51

drifting clouds were passing the planet from the N. W. at the moment, and when the satellite was first seen, it had evidently been some seconds out of eclipse. There were eight seconds between the two last observations, which was about the time occupied by the cloud in passing from one station to the other. The sky was cloudless in Chowringhee.

	h. m.	*s.*	*h. m. s.*
3*rd Nov.*—Emersion of II Sat. observed by Mr. Gray, tel. *c.*	7 52	8	5 53 20
4*th Nov.*—Emersion of I Sat. observed ;			
By Captain Ross, with telescope *c.* 42 inches.	6 48	38	5 53 46
By Lieut. Lloyd, with the telescope used by Captain Ross on the 19th ultimo, the object glass tarnished, the emersion was not visible until 14 seconds after. The evening was very favorable and clear.			
By Mr. Logan, at the Sur. Gl. office. *c.*	6 48	12	5 53 20
10*th Nov.*—Calcutta, very clear sky ; moonlight, (16th day.)			
Emersion of III. Sat. Gray, telescope *c.* very good	7 54	5	5 53 33
Gordon, *d.* 60 in. 3.7 ap. 110 p. doubtful,	7 54	56	5 54 34
Logan, *d.* 60 in. 3.7 ap. 99 p. moonlight,	7 53	41	5 53 19
Em. II. Sat. Prinsep, 10 feet Refl. *a.* bad focus,	10 27	17	5 52 53
Gordon, *b.* good,	10 27	27	5 53 03
Gray, *c.* good,	10 27	27	5 53 03
Logan, *c.*	10 27	32	5 53 08

11*th Nov.*—Em. I. Sat.	Prinsep,	*b.*	very good,	8	43	57	5	53 12
	Gordon,	*d.*	do.	8	44	05	5	53 20
	Logan,	*d.*	do.	8	43	48	5	53 03
	Barrow, (power 70)	*c.*	do.	8	44	32	5	53 47
17*th Nov.* Imm. III. Sat.	Barrow,	*c.*	do.	9	0	43	5	54 34
18*th Nov.*—Em. I. Sat.	Gordon,	*d.*	very clear,	10	40	01	5	53 19
	Prinsep,	*b.*	do.	10	39	47	5	53 05
	Wilcox,	*c.*	do.	10	39	50	5	53 08
	Logan,	*d.*	do.	10	39	43	5	53 01
	Barrow,	*c.*	do.	10	40	06	5	53 24
27*th Nov.*—Em. I. Sat.	Gray,	*c.*	good,	7	5	10	5	53 10
	Logan,	*c.*	doubtful,	7	5	15	5	53 32
	Barrow,	*c.*	do.	7	5	22	5	53 39

VII.—*Abstract of Observations of the Temperature, Pressure, and Hygrometrical state of the Air in the vicinity of Dehli. By Major* Oliver.

The observations were made at various places within the Dehli territory, not exceeding 50 miles distance from the city, and generally much less. It would of course have been more satisfactory had they been made at one and the same place, but I was not stationary and had not always the opportunity of making my observations at the most favourable hours: notwithstanding these disadvantages, I trust it will be thought that the mean results are at least as consistent as could reasonably be expected.

Referring to table I, my barometer is one of Dollond's: it was compared five or six years ago with the one then used in the Surveyor General's office, when it stood ·055 higher than the latter: the reduction has been made accordingly. The mean daily range during these eleven months, appears to be too little; but on taking the mean of a long series of observations made in camp, I find the mean is ·103. I had no observations at Gúrgaon in April, but as the Barometer in that month stands at nearly its mean height, the want of these is perhaps of little consequence. It will be observed, that there is an extreme difference of about 120 feet in the elevation of Gúrgaon above Calcutta, as deduced from the observations at the two places for the several months: when it is considered that each of the results in the Table is deduced from the mean of about sixty observations at each place, it is evident how little dependence can be placed on the results of *single* observations at places so far distant*.

* The difference of the altitudes deduced from the monthly means, is just of the nature which was anticipated in consequence of the annual barometrical range increasing with the latitude; (vide page 30 of this Journal,) for all places in India north of Calcutta, the summer observations will give too high an altitude,—the winter, one too low: for southern latitudes the reverse will occur. We hope to furnish a correction for this hereafter.—Ed.

The observations in table II, were made at various places within the limits already mentioned. The mean temperature of each month has been deduced generally, from the observations at sunrise and 2½ P. M.; but occasionally (when others were wanting) from the observation at sunset only; in the latter case 3° have been deducted from the temperature at that time; as I find from the mean of a long series of observations, that the temperature at sunset is 3° above the mean of maximum and minimum. For the temperature of the night I have taken the mean of sunset and sunrise.

In Table III, for the dew points (headed S in the table) I have used the formula $\left(f = F' - 6{\cdot}056 \frac{D^{1.233}}{L} \frac{B}{30}\right)$ given in the GLEANINGS for July 1829, page 192, altering the constant 6.056 to 5.84, for, when I received this number of the GLEANINGS, having by me Daniell's Meteorological Essays, and finding that the table of the force of vapour there given, page 596, differed from the one used by the author of the valuable paper above referred to, I had the curiosity to calculate the value of $\frac{A}{e}$ (see the paper same page) and found it = 5.84; the difference is not perhaps very material, but as I have always used the table of the force of vapour given in Daniell's Essay above quoted, I thought it more consistent to use the constant modified accordingly. The two last columns of table III, (mean dew point and mean comparative tension) have been thus formed: the mean dew point is the mean of all the observations (or rather of all the results derived from the wet thermometer depressions) for several months: the force of vapour answering to the mean dew point, divided by that answering to the mean temperature of the month, gives the mean comparative tension. I have adopted this mode, not only from my having by necessity or choice so often altered my hours of observing, but from the consideration that as the dew point generally varies but little during the day, it appeared to me that it would be more accurate to deduce the mean comparative tensions from even one observation of the dew point and the mean temperature, than by taking it as the mean of results calculated for any two or more hours, not excepting even sunrise and 2½ P. M. How far I may be right in this, I leave to more competent judges to decide.

Table IV, is nothing more than an abstract of table III, the force of vapour at the dew point being substituted for the dew point itself. It appears, that May is the driest and August the dampest month, considering the comparative tensions as the fairest scale of the humidity of

the air. There is a less quantity of aqueous vapour in a given quantity of air in January than in May, but the difference of temperature makes the drying power of the air in the latter month superior to that in the former. I find by a rough calculation that the weight of aqueous vapour in a cubic foot of air varies from 3·3 grains in January to 10.3 in August. Comparing the driest month at Dehli with the driest in Calcutta, I find the ratio as 5 to 3 nearly : the dampest month is nearly the same at both places, and the mean of the year as 5 to 4 nearly : I should have expected a much greater difference.

I have added a table of the factor $\left(5{\cdot}84\frac{D^{1.233}}{L}\right)$ for finding the dew point from observations of the temperature of the air and that of the wet thermometer; also the table of the force of vapour which I have used in my reductions : should these be thought worth printing, it will be as well to give an example of their use to prevent misconception. Suppose the temperature of the air 100°, that of the wet thermometer 70° ∴ D = 30°, the barometer standing at 27·0 inch; required the dew point and comparative tension?

For wet thermometer 70° and D = 30° Table IV. gives	·402		
For barometer 27.0 inch, deduct ·402 × ·1 =	·040		
	·362		
Force of vapour at 70°	·723		
Dew point 49°.9—force of vapour answering thereto	= ·361	log. =	9·55751
Force of vapour at temp. of air 100°	= 1·874	colog. =	9·72723
Comparative tension	= 0.193	=	9·28474

TABLE I. *Barometer reduced to* 32°, *and Temperature of the external Air observed at Gúrgaon.*

Year and Month.	10 A. M.		4 P. M.		MEAN.		Daily range of Bar.	Monthly difference from mean.	Elevation of Gurgaon above Calcutta.
	Bar.	Temp.	Bar.	Temp.	Bar.	Temp.			
	in.	°	in.	°	in.	°	in.	in.	Feet.
May, 1829.	28.832	100.6	28.712	107.6	28.772	104.1	.120	— .182	868
June, ...	.813	96.1	.714	100.5	.763	98.3	.099	— .191	841
July, ...	.717	84.0	.646	87.0	.682	85.5	.071	— .272	855
August, ...	.791	83.9	.711	85.8	.751	84.8	.080	— .203	803
September,	.882	86.6	.798	91.7	.840	89.2	.084	— .114	807
October, ..	29.034	84.5	.955	91.1	.995	87.8	.079	— .041	808
November,	.223	72.7	29.143	79.1	29.183	75.9	.080	+ .229	750
December,	.255	62.4	.158	71.3	.207	66.8	.079	+ .253	771
Jan. 1830.	.230	66.0	.140	74.9	.185	70.5	.090	+ .231	854
February,	.153	69.8	.067	76.0	.110	72.9	.086	+ .156	813
March, ..	.052	77.3	28.963	83.4	.008	80.4	.089	+ .054	814
April, ...	..	..	..	..	..	..	..	..	..
					28.954		.089		817

TABLE II. *Mean Temperature of each month for three years, as observed at various places in the vicinity of Dehli.*

	1827.		1828.		1829.		MEAN.		DIFF. FROM MEAN.	
	day.	night.	day.	night.	day.	night.	day.	night.	day.	night.
	°	°	°	°	°	°	°	°	°	°
January, ..	56.7	51.4	53.7	50.3	58.4	53.5	56.3	51.7	— 19.7	— 19.1
February,..	66.0	58.6	56.8	51.8	62.0	55.8	61.6	55.4	— 14.4	— 15.4
March,....	74.0	66.0	70.6	63.8	73.0	66.0	72.5	65.3	— 3.5	— 5.5
April, ...	83.8	75.5	79.3	74.2	86.6	77.9	83.2	75.9	+ 7.2	+ 5.1
May,.....	90.4	..	87.0	82.2	96.7	88.9	91.4	85.6	+ 15.4	+ 14.8
June, ...	91.7	..	93.7	90.4	92.0	90.0	92.5	90 2	+ 16.5	+ 19.4
July,.....	90.1	..	88.2	85.5	79.7	80.6	86.0	83.0	+ 10.0	+ 12.2
August, ..	85.5	..	83.6	80.9	82.5	79.4	83.9	80.1	+ 7.9	+ 9.3
September,	83.2	79.3	85.2	..	81.7	77.6	83.4	78.5	+ 7.4	+ 7.7
October, ..	77.7	70.2	76.2	71.6	77.5	72.4	77.1	71.4	+ 1.1	+ 0.6
November,	65.7	60.3	65.2	55.2	65.8	61.7	65.6	59.1	— 10.4	— 11.7
December,	57.1	53.1	62.3	54.8	57.3	52.1	58.9	53.3	— 17.1	— 17.5
Means.....	76.8		75.2		76.1	71.3	76.0	70.8		

The mean of six observations of the temperature of water in wells from 74 to 94 feet deep gives 74°.0: varying from 71° to 78°.

TABLE III. *Temperature of the Air—Depression of Moist Thermometer (D), Point of Saturation (S), or the dew Point, and mean comparative Tension, (T.)*

Year and Month.	SUNRISE.			10 A. M.			NOON.		
	Temp.	D.	S.	Temp.	D.	S.	Temp	D.	S.
	°	°	°						
April, 1827.	67.0	8.9	52·4						
May, ...	77.5	9.9	63.5						
June, ...	82.1	9.4	69.0						
July, ...	82.1	6.3	73.8						
August, ...	79.3	2.7	75.9						
September,.....	74.9	2.3	72.0						
October,.....	61.5	4.9	53.8						
November, ...	49.7	4.1	42.4						
December, ...	46.5	0.8	45.2						
January, 1828. ..	43.8	1.2	41.8						
February, ...	42.3	1.5	39.7						
March,.....	52.5	5.1	43.3						
April, ...	63.1	8.3	48.7						
May, ...	71.3	14.0	46.0						
June, ...	82.8	11.9	65.5	96.5	20.7	66.0			
July, ...	81.7	5.2	75.0	92.3	12.6	75.4			
August, ...	78.4	0.8	77.5	85.0	6.0	77.3			
September,.....				87.0	7.8	76.8			
October,.....				87.0	14.0	66.8			
November, ...				72.0	14.0	47.2	76.0	17.0	44.8
December, ...							73.0	13.0	50.8
January, 1829. ..							68.0	12.0	46.4
February, ...							74.0	15.0	47.3
March,.....							90.0	23.2	50.2
April, ...							99.0	30.0	45.5
May, ...				100.6	26.0	60.2			
June, ...				96.1	17.5	71.7			
July, ...				84.0	5.0	77.7			
August, ...				83.9	4.9	77.7			
September,.....				86.6	11.9	70.0			
October,.....				84.5	18.4	54.2			
November, ...				72.7	15.4	44.1			
December, ...				62.4	13.0	35.0			
January, 1830. ..				66.0	14.7	35.2			
February, ...				69.8	8.8	55.9			
March,.....				77.3	15.8	49.8			

TABLE III. *(continued.)*

Year and Month.	2.30 P. M. Temp.	D.	S.	4 P. M. Temp.	D.	S.	SUNSET. Temp.	D.	S.	MEAN. S.	T.
	°	°					°	°	°	°	
April, 1827...	100.5	30.3	47.8				84.1	19.1	517	50.1	.320
May, ..	103.2	29.8	55.0							59.2	.359
June, ..	101.4	24.1	65.8							67.4	.456
July, ..	98.1	18.4	72.5							73.2	.581
August, ..	91.8	11.4	76.7							76.3	.744
September,..	92.2	14.0	73.0				83.8	8.7	72.0	72.5	.706
October, ..	94.0	25.8	49.5				78.9	16.7	50.0	51.7	.412
November,..	81.8	21.4	40.8				70.9	15.3	41.3	41.6	.425
December,..	67.7	10.5	49.6				59.8	5.5	50.7	47.4	.706
Jan. 1828. ..	63.6	9.2	47.4				56.8	5.5	47.5	44.6	.723
February, ..	71.3	16.7	37.7				61.3	10.4	41.3	38.7	.518
March, ..	88.8	27.0	34.2				75.0	18.2	40.0	38.7	.324
April, ..	95.5	28.6	43.0				85.3	23.3	41.0	45.9	.317
May, ..	103.0	33.0	43.3				93.0	24.1	52.7	44.7	.238
June, ..	104.7	27.9	62.1	101.5	24.7	64.6	97.9	24.3	60.6	63.8	.379
July, ..	94.8	15.2	74.0	93.6	15.1	72.8	89.2	11.7	73.3	74.5	.644
August, ..	88.7	8.3	77.9	87.0	7.0	78.0	83.4	3.9	78.6	77.7	.827
September,..				88.0	9.9	74.8				75.8	.738
October, ..				92.0	22.0	56.5				61.7	.615
November, ..				79.0	20.0	40.3				44.1	.475
December, ..										50.8	.668
Jan. 1829, ..										46.4	.651
February, ..										47.3	.595
March, ..										50.2	.457
April, ..										45.5	.248
May, ..				107.6	33.3	52.3				56.2	.265
June, ..				100.5	23.2	66.4				69.0	.476
July, ..				87.0	7.0	78.0				77.8	.941
August, ..				85.8	6.7	77.5				77.6	.854
September,..				91.7	15.8	69.2				69.6	.671
October, ..				91.1	25.6	44.5				49.4	.382
November, ..				79.1	20.6	38.3				41.2	.417
December, ..				71.3	18.1	32.5				33.8	.424
Jan. 1830. ..				74.9	20.5	29.6				32.4	.394
February, ..				76.0	14.1	52.3				54.1	.654
March, ..				83.4	21.9	42.0				45.9	.416
									Mean first year,	55.1	.523
									second,	56.9	.550
									third,	54.4	.512
									Mean of three years,	55.5	.528

TABLE IV. *Comparative Tension, (T.) and Force of vapour at the Dew point, (F.)*

	T.	F.		T.	F.		T.	F.	MEANS.	T.	F.
Ap. 1827.	.320	.363	Ap. 1828,	.317	.312	April, ..	.248	.308	April, ..	.295	.328
May, ..	.359	.501	May, ..	.238	.299	May, ..	.265	.450	May, ..	.287	.417
June, ..	.456	.663	June, ..	.379	.586	June, ..	.476	.699	June, ..	.437	.649
July, ..	.581	.804	July, ..	.644	.840	July, ..	.941	.936	July, ..	.722	.860
August,..	.744	.891	August,	.827	.933	August,	.854	.930	August,	.808	.918
Sept. ..	.706	.786	Sept. ..	.738	.876	Sept. ..	.671	.713	Sept. ..	.705	.792
October,	.412	.384	Oct. ..	.615	.546	October,	.382	.354	Oct. ..	.470	.428
Nov. ..	.425	.266	Nov. ..	.475	.292	Nov. ..	.417	.262	Nov. ..	.439	.273
Dec. ..	.706	.329	Dec. ..	.668	.372	Dec. ..	.424	.199	Dec. ..	.599	.300
Jan.1828,	.723	.298	Jan.1829,	.651	.317	Jan.1830.	.394	.189	Jan. ..	.589	.268
February,	.518	.239	Feb. ..	.595	.328	Feb. ..	.654	.418	Feb. ..	.589	.328
March,..	.325	.234	March,	.457	.365	March,..	.416	.312	March,..	.399	.305
Means.	.523	.480		.550	.506		.512	.481		.528	.489

TABLE V. *For finding the dew Point from the Temperature of the Air, and that of the Wet Thermometer.*

D.	Temperature of the Wet Thermometer.									
	110°	100°	90°	80°	70°	60°	50°	40°	30°	20°
1°	.006	.006	.006	.006	.006	.006	.007	.007	.007	.007
2	.013	.013	.013	.014	.014	.014	.014	.014	.015	.015
3	.021	.022	.022	.023	.023	.023	.024	.024	.025	.025
4	.030	.031	.032	.032	.033	.034	.035	.035	.036	.037
5	.040	.041	.042	.043	.044	.045	.046	.047	.048	.049
6	.051	.052	.053	.054	.055	.056	.057	.058	.060	.061
7	.062	.063	.065	.066	.067	.068	.070	.071	.073	.075
8	.073	.074	.076	.077	.079	.081	.082	.084	.086	.089
9	.084	.085	.087	.089	.091	.093	.095	.097	.100	.103
10	.095	.097	.099	.101	.104	.106	.109	.111	.114	.117
11	.107	.109	.111	.114	.116	.119	.122	.125	.128	
12	.120	.122	.124	.127	.130	.133	.136	.139	.142	
13	.132	.134	.137	.140	.143	.146	.150	.153	.156	
14	.145	.147	.150	.154	.157	.160	.164	.168	.171	
15	.157	.160	.164	.168	.171	.175	.179	.183	.187	
16	.170	.174	.177	.181	.185	.190	.194	.198	.203	
17	.183	.187	.191	.195	.199	.204	.209	.214		
18	.196	.200	.205	.209	.214	.218	.224	.229		
19	.210	.215	.219	.224	.229	.234	.239	.245		
20	.224	.229	.233	.239	.244	.250	.256	.261		
21	.238	.243	.247	.253	.259	.265	.272	.278		
22	.252	.258	.263	.269	.276	.282	.289	.295		
23	.266	.272	.278	.284	.290	.297	.305		Bar.	Mul.
24	.281	.286	.292	.299	.306	.313	.321			
25	.295	.301	.307	.314	.321	.329	.337		29.5	.02
26	.309	.316	.323	.330	.337	.345	.353		29.0	.03
27	.324	.331	.339	.347	.354	.362	.370		28.5	.05
28	.339	.346	.354	.362	.370	.379	.388		28.0	.07
29	.354	.362	.370	.378	.386	.395			27.5	.08
30	.369	.377	.385	.394	.402	.411			27.0	.10
31	.385	.393	.402	.411	.420	.429			26.5	.12
32	.400	.408	.417	.427	.437	.447			26.0	.13
33	.416	.425	.434	.444	.454	.464			25.5	.15
34	.431	.440	.450	.460	.470	.480			25.0	.17
35	.447	.457	.467	.476	.487				24.5	.18
36	.462	.472	.482	.493	.504				24.0	.20
37	.478	.488	.499	.510					23.5	.22
38	.494	.505	.516	.527					23.0	.23
39	.510	.521	.532						22.5	.25
40	.526	.538	.549						22.0	.27

N.B.—The numbers in this Table to be multiplied by $\frac{B}{30}$, B being the height of the Barometer: or, which will be easier, deduct therefrom the product of the tabular number by the multiplier opposite the height of the barometer in the small table above*.

* We omit Table VI. of the Force of Vapour, because it may be found in any physical or chemical work; besides which, the tensions of vapour at temperatures between 60 and 120, require to be more accurately determined for the present state of atmospherical knowledge.—ED.

VIII.—*Proceedings of the Asiatic Society.*

Wednesday, 7th November, 1832.

The Honorable Sir Edward Ryan, President, in the Chair.

Read the proceedings of the last Meeting.

The following Members were ballotted for, and unanimonsly elected:—Monsieur Richy, Captain Sage, Rajah Kalikrishen.

The communication from Baron Ferussac, referred to the Committee of Papers at the last Meeting, having been considered by them, they report, that they consider it unadvisable to take any share, but recommend to the Society to subscribe for a complete annual set of the Bulletin Universel.

With regard also to the List of Books submitted by Dr. Tytler, the Committee recommend, that only such as have an oriental character be purchased.—Resolved, that the recommendations of the Committee be adopted.

The Secretary reported the completion of the 17th volume, also the preparation of an ample Index to the first 17 volumes.—Resolved that the Index be printed.

The Secretary to the Physical Class reported, that it had been determined to recommend a further grant of 500 rupees for the Boring Experiment, on condition of that being the last grant to be made by the Society.—Resolved, that the grant, subject to the stipulation, be confirmed.

Resolved also, as a matter of general convenience, that in future the Proceedings of the Physical Class shall form part of the business of the General Meetings, which shall be held once a month on the first Wednesday, as heretofore.

Museum.

An Image of Bhairava. Presented through Dr. Twining on the part of General O'Halloran.

This image of Mahadeo was found at Bijrah Ghat, situated in a wild jungle on the right bank of the Nerbadda, on the rout from Jabalpur to Garwarreh, about 14 miles from the former town, and about three miles from the high road; it is approached through heavy ravines.

On the top of a circular hill, about 150 feet high, in the centre is a temple dedicated to Mahadeo, and on its brow, surrounding the temple, is an arcade, divided into 72 compartments, in each of which is a large image, of good workmanship, more or less mutilated, as tradition states, by the army of Aurangzeb, when in progress to the Dekhin. At the foot of this hill, and at a small distance, close to a temple, falling into decay, the above image was found, and conveyed to Ságar, and from thence to Calcutta.

The arcades on the crest of the hill appear to be very ancient, and are built of large stones, without cement.

Bijrah Ghat is considered as a sacred spot, where an immense crowd of pilgrims congregate three days in the year, for the purpose of traffic and devotion.

A figure of Nemnáth. Presented through Mr. Kyd.

Read a letter from Captain Boileau, presenting several coins dug up at Agra.

The Secretary reported, that the Committee had authorised the purchase of a set of Roman Coins. A list of which, prepared by Mr. Prinsep, was submitted.

The head of a Saw-fish. Presented by Mr. Hutchinson.

The thanks of the Society were voted for the above.

Library.

Read a letter from Counsellor Von Hammer, presenting the following works:

1. 8th Vol. of the Ottoman History.
2. Persian Translation of the Meditations of Marcus Antoninus.
3. Account of Oriental Manuscripts in the Library of Turin.
4. Nos. 53 to 56 of the Johrbucher of Vienna.

"The Ass overladen." Presented by Mr. Fisher.

Read a letter from the Secretary to the Royal Academy of Bourdeaux, presenting 2 vols. of their Proceedings.

Transactions of the Geological Society, part 2nd of the 3rd Vol. presented by the Society.

Notes on the Hitopodesa, by Messrs. Schlegel and Lassen. By the authors.

New edition of De Sacy's Arabic Grammar. By the author.

Memoir on the Mussulman Religion in India, by M. Garcin de Tassy. By the author.

2 small Persian Manuscripts on Astrology, &c. By Ensign Readbold.

Meteorological Journals for August and September, 1832. By the Surveyor General.

Resolved, that the thanks of the Society be returned for the above.

The Secretary reported the purchase of the following Books.

1. Franklin's Observations made on a tour from Bengal to Persia, 1 vol.
2. Scott's Ferishta's History of Dekhan, 2 do.
3. Bentley's Hindu Astronomy, 1 do.

Literary.

Translation of an extensive Bauddha Vocabulary and Abstract of a Tibetan Medical work. Made and presented by Mr. Csoma de Körös.

A notice of some of the Arabic Poets. By Ensign Readbold.

An Abstract Account of the contents of the volumes presented by Ensign Readbold. By Baboo Ramdhun Shèn.

Read Extracts from a Letter from Major Burney, from Ava, to the Secretary, regarding the historical records of that country.

Inscriptions from Vijayanagar, with translations and a pedigree of the Kings of that city. Presented by Mr. Ravenshaw.

Read also observations on the same by the Secretary.

The thanks of the Society voted for the above, and the papers referred to the Committee.

X.—Scientific Intelligence.

Slate Quarries in the Western Ghâts.

From official reports lately communicated from the Bombay Government to this presidency, with the perusal of which we have been kindly favored, we learn that Lieut. Jervis of the Bombay Engineers has brought forward propositions for the working of quarries in the extensive clay slate formations in the southern Marhatta country. That officer has sent down specimens of slates adapted to the several purposes of roofing, flooring, monumental stones, dials, dripstones, whet-stones, and drawing slates; accompanied with samples of marble, porphyry, lithographic stone, mill-stone, sand-stone, &c. all of which he shews may be turned to great advantage in an economical point of view. He calculates, that slates may he substituted for tiles in roofing and flooring, with a saving of weight and expence—the weight of a 100 square feet of slate being 1 to 3 cwts. while that of single tiles is 7 cwts. The expence of the slates at Bombay would be 8 to 15 rupees per 100 sq. ft. cut and squared. There seems, however, a difference of opinion on the subject among those conversant with building; and it does not appear, that the best slates in Europe are much, if at all, lighter than the tiles used in this country. The slates would, like the Chunar stones used in our western provinces, admit of the beams being placed further apart, and of the burgars being dispensed with; and this alone, if the land carriage be not very heavy, will produce a demand for so useful and elegant a roofing material. The following is an extract from Captain Jervis's report on the subject, dated March, 1832.

"The above varieties of slate alternate with strata of the most beautiful descriptions of marble and porphyry; in the latter of which are found nodules of jasper, of considerable size, and those strata pass off into micaceous schist, hornblende, corundum, and trap, with a less distinct transition into alum-slate, and secondary limestone.

"The strata run nearly east and west, and exhibit all the characteristics of the primitive rocks to which they pertain, both in respect of their fracture, dip, and the absence of all vestiges of animal remains; so far as I have yet been able to examine them, a small portion of these valuable productions lie within the Honorable Company's district of Bajulkota; but nine-tenths, and those of the very finest quality, are in the territories of a number of independent jaghírdars and chieftains. The natives have no name for slate; are utterly ignorant of its nature, use, or the method of quarrying it; and after a most diligent search in every village, where I have traced it, I have not found a bit, so much as an inch square, in any wall, or building, or in any way whatever applied to the purposes of life. I shewed the native shop-keepers, in the presence of a number of people, its value as a writing material, which delighted and astonished them beyond measure; but from the native chieftains downward to the lowest individual, not one, though living on the very spot, was acquainted with its use or value. The chieftains are anxious that I should carry on my researches within their respective limits, as likely to be attended with great advantage to themselves and their people, as well as to the community at large. The finest description of roofing slate is at Lokapur, not in the Company's territory; but there are scarcely any two villages which have the same kinds of slates—some kinds are good for one, others for another, purpose. The districts in which these slates are found are most commodiously situated within a short distance of the confluence of the Gatparba and

Kristna rivers, which latter flows through Rastea's, the Nizam's, the Nagpur Rajah's, and the Honorable Company's territories, into the bay of Bengal; in its way hence, it traverses the Kalkapur Rajah's and Satarah Rajah's territory, and the states of the Putwárdhans and other numerous jaghírs, independent of Government.

"The existence of these extensive beds of marble has hitherto been equally unknown and despised: as the several varieties are very hard, they are little sought after for building purposes, and I have scarcely met with twenty houses plastered, or even built with lime—to which at least it might be supposed the natives would have applied it where the marble abounds."

The existence of the slate, although but little worked, seems to have long since been pointed out by Mr. Thomas Marshall, Statistical Reporter to the Bombay Government, from whose report, dated Dharwar, 29th July, 1821, we take the folowing extract.

"The next most general rock is a bluish clay slate, which however never assumes the elevation of hills, but is seen to traverse a great part of the country on both sides of the Gatparba, in the direction of W. by N. and E by S. Its layers are almost exactly perpendicular to the surface of the earth. It plainly dips under the sand-stone hills—one of its softest quarries, near Kundargí, supplies the surrounding country with whet-stones; but they are of a very inferior quality. It is not uncommon for a few layers of this clay slate to pass suddenly into semi-transparent greyish-white felspar, which in a few yards resumes the colour and texture of the slate. Throughout, this slate is traversed by numerous most irregular veins, which have the appearance of having once been a liquid matter poured into transverse and curvilinear fissures, which run in all directions. The matter filling the veins seems a mixture of quartz and clay, and is much harder than the substance of the slate; very beautiful crystals of quartz are frequently found in it."

XI.—*Progress of European Science.*

Theoretical Geology.

Following up the design proposed in our notice, of the progress of Electrical Science, we seek the most concise, comprehensive, and authentic materials for our present review, in the annual addresses of the presidents of the Geological Society. These do not merely embrace the practical labours of the associates of the Society itself at home and abroad, in their examination of the earth's surface, the description of rocks, the order of strata, and the classification of the fossils of every formation; but they at the same time deliver what we may consider an orthodox judgment *ex cathedrâ*, upon the various theories which the most eminent authors of the day have promulgated to the world: such, in the present period, are—the remarks of Herschel upon the influence of Planetary perturbation on Geological phenomena;—Lyell's estimate of the effect of causes still in action, upon the past modifications of the earth's crust, and Elie de Beaumont's theory of the contemporaneous upheaving of parallel mountain ranges;—the temperature of the globe;—the connection of thermal springs with volcanic action;—the gradual transition of fossil species, and a multitude of other questions of the greatest interest to the geological theorist. Thus Geology has almost ceased to be the science of observation alone, as it was so long its boast to be called; and it now challenges a share in the physical speculations of the astronomer, the dynamical calculations of the mecanician, and the primeval chronology of the cosmogonist and historian. Upon the

first of these connections, the Rev. Professor SEDGWICK thus states the actual state of opinions.

"Some great and simple problems in physics have so immediate a connexion with the structure of the earth, that we may almost claim their solutions for our own.

"The form put on by a fluid body in rotation is an abstract question, which might or might not have any real application to the bodies of our solar system. But direct geodesic observations, as well as the relative position of land and water, prove that the stratified matter on the crust of the earth is deposited in near conformity to the surface of a true spheroid of rotation. Here then we have, in spite of one of the arbitrary dogmas of the Huttonian theory, an indication of a primeval fluidity before the commencement of any one phænomenon coming within the direct speculations of geology. And again, the direct phænomena of geology are in the strictest harmony with this conclusion. For, after passing through a few stages of stratified matter, formed by the degradation of matter in a prior state of solidity, we are conducted to other unstratified masses with that crystalline structure which implies an anterior fluidity—in some cases unequivocally, and in all cases probably, derived from the solvent power of heat.

"But if the earth ever existed in any state approaching to igneous fusion, it must have undergone a great diminution of temperature, before it was fitted for the habitation of any organized being. And here again geological facts are at least in a general accordance with the hypothesis; for the forms of the living beings, entombed among the ancient strata, not only seem to indicate a high temperature, but also a gradual refrigeration of the surface of the earth.

"Here however we meet with an unexpected difficulty. If during any period, the earth have undergone a sensible refrigeration, it must also have undergone a contraction of its dimensions; and also, as a necessary consequence of a well known mechanical law, an acceleration round its axis of rotation. But direct astronomical observations prove, that there has been no sensible diurnal acceleration during the last 2000 years; and therefore, by inverting the steps of the reasoning, we prove—that during that long period there has been no sensible diminution in the mean temperature of the earth. This difficulty does not, however, entirely upset the previous hypothesis: it only proves, that the earth had reached an equilibrium of mean temperature before the commencement of good astronomical observations.

"But if our speculations are thus limited and guided by the observations of astronomy, we have in part paid back to that exalted science the obligations we owe to it. The great bodies of our system leave behind them no marks to track their progress through the heavens; and the vast secular periods we can calculate, reaching to ages long anterior to the records of our being, might be mere fictions of the mind, which have never had any archetype in nature. But in the phænomena of geology, we are carried back, almost at our first step, into times unlimited by any narrow measures of our own; and we exhibit and arrange the monuments of former revolutions, requiring for their accomplishment perhaps all the secular periods of astronomy. Nor is this all. We show, by help of records, not to be misinterpreted, that during this vast lapse of time, in the very contemplation of which our minds become bewildered, the law of gravitation underwent no change, and the powers of atomic combination were still performing their office.

"If the phænomena of geology be coeval with long returning astronomical periods (and it is at least impossible to prove the contrary), a question may arise,

whether some of the first difficulties we meet with (such as those connected with the transport of diluvial gravel, and the gradual diminution of temperature) may not be attributed rather to effects of planetary perturbation than to any change in the internal condition of the earth. This question has been admirably discussed in a recent paper by Mr. Herschel.

"Of all the secular inequalities produced by perturbation, those of the moon alone can produce any visible effects upon the tidal level. The lunar inequalities considered are of two kinds—change of mean distance, and change of eccentricity. Both are confined within narrow determined limits; and Mr. Herschel shows, by actual calculation, that they could not have produced any of the great movements contemplated in geology.

"The planetary perturbations of the orbit of the earth are next considered, and the influences they may have produced on the diffusion of light and heat. The secular variation of obliquity is too small to have ever caused any sensible effect on our climates: but he proves, by direct calculation, that the mean annual diffusion of solar light and heat varies inversely as the minor axis of the orbit; or, in other words, increases or diminishes with the increase or diminution of eccentricity. Now, as a matter of fact, the eccentricity of the earth's orbit has been for many ages slowly diminishing, and is now very small; but the limits of its secular variation have not yet been calculated. He assumes, therefore, hypothetically, that the eccentricity of our orbit *may* once have been as great as that of some of the inferior and superior planets; and on that supposition, he proves, that the slow diminution of eccentricity *may* have produced a gradual change of climate, of the very kind indicated by geological phænomena.

"Into the solution of the great problem of the heavenly bodies, there enter only a few simple and unchangeable mechanical elements, and the conclusions are of a simplicity corresponding to the simplicity of the premises. All the celestial movements return into themselves; and even the most complex of the deviations produced by mutual perturbation, are confined within narrow limits, and are completed in secular periods. The solution of this problem is incontestably the greatest triumph of exact science. But with what semblance of physical truth can we apply such mathematical results as these to the great phænomena of geology—where the combinations are mutable and indefinite—where we have no vestige of returning periods—and where the fixed elements of force are either unknown or imperfectly comprehended?

If all the complex groups of crystalline and stratified rocks; if, in a word, all the material things existing on the surface of the globe, be bound to each other by laws like those which govern the movements of the heavenly bodies—*then* every material combination we now see must re-appear with all its complicated relations after the lapse of some long period of time. But would not such a supposition be now regarded as the mere wantonness of hypothetical extravagance? And let it not be said, that it is only in the greater combinations on the surface of the earth that we are to look for returning cycles. Great and small have no meaning, except in reference to us and our conceptions. The earth is an atom in comparison with the visible creation; and all we now behold may be but as an atom in comparison of that which is unseen; and the meanest combinations of material things submitted to our senses propagate their influence through all space co-extensive with gravitation, and play their part in keeping up the stability of the universe.

To the supreme Intelligence, indeed, all the complex and mutable combinations we behold, may be but the necessary results of some simple law, regulating every ma-

terial change, and involving within itself the very complications, which we, in our ignorance, regard as interruptions in the continuity of Nature's work. In contemplations of this kind, our understanding is lost among the stern doctrines of philosophical necessity. But, as far as regards us and our faculties, there is no such thing on earth as undeviating moral or physical necessity. For as, in morals, necessity is made, in part, at least, subordinate to the freedom of human will, so, in physics, the continued action of immutable causes may and does co-exist with mutable phænomena.

"The study of the great physical mutations on the surface of the earth is the business of geology. But who can define the limits of these mutations? They have been drawn by the hand of Nature, and may he studied in the record of her works —but they never have been, and never will be fixed, by any guesses of our own, or by any trains of *á priori* reasoning, based upon hypothetical analogies. We must banish all *á priori* reasoning from the threshold of our argument; and the language of theory can never fall from our lips with any grace or fitness, unless it appear as the simple enunciation of those general facts, with which, hy observation alone, we have at length become acquainted."

The above observations are introductory to the Professor's objections to Mr. Lyell's system of "geological dynamics," which, althongh highly praised, as a new province of the science studied with immense research, and pregnant with facts necessary to be borne in mind, in the explanation of every observed phænomenon, seems to him to have been strained beyond the limits of logical inference, in its application to the vast efforts of displacement and deposition, of the gigantic epoch of geology.

"Mr. Lyell appears not only as the historian of the natural world, but as the champion of a great leading doctrine of the Huttonian hypothesis; in the language of an advocate, he sometimes forgets the character of an historian. In reading his graphic and eloquent descriptions of the mighty works of degradation yearly going on through the eastern shores of England, or of the enormous weight of solid matter hourly rolled down by the Ganges* or the Missisippi, I have fancied, that the earth was sliding from under my feet, and that it would soon pass away, like the sand of an hour-glass, beneath the waters of the ocean.

"But are there no antagonist powers in nature to oppose these mighty ravages— no conservative principle to meet this vast destructive agency? The forces of degradation very often of themselves produce their own limitation. The mountain torrent may tear up the solid rock, and bear its fragments to the plain below: but there its power is at an end, and the rolled fragments are left behind to a new action of material elements. And what is true of a single rock is true of a mountain chain; and vast regions on the surface of the earth, now only the monuments of spoliation and waste, may hereafter rest secure under the defence of a thick vegetable covering, and become a new scene of life and animation.

"It well deserves remark, that the destructive powers of nature act only upon lines, while some of the grand principles of conservation act upon the whole surface of the land. By the processes of vegetable life, an incalculable mass of solid matter is absorbed, year after year, from the elastic and non-elastic fluids circulating round the earth, and is then thrown down upon its surface. In this single operation, there is a vast counterpoise to all the agents of destruction. And the deltas of the Ganges and the Missisippi are not solely formed at the expense of the

* For a correction of the estimate of Major Rennell, see the pages of this Journal and of the GLEANINGS.

solid materials of our globe, but in part, and I believe also in a considerable part, by one of the great conservative operations by which the elements are made to return into themselves.

"According to the principles of Mr. Lyell, the physical operations now going on are not only the type, but the measure of intensity of the physical powers acting on the earth at all anterior periods: and all we now see around us is only the last link in the great chain of phænomena, arising out of a uniform causation, of which we can trace no beginning, and of which we see no prospect of the end. And in all this, there is much that is beautiful and true. For we all allow, that the primary laws of nature are immutable—that all we now see is subordinate to those immutable laws—and that we can only judge of effects which are past, by the effects we behold in progress. Whether there be, or be not, any physical traces of a state of things anterior to the commencement of our geological series of deposits, is a question of no real importance. But to assume, that the secondary combinations, arising out of the primary laws of matter, have been the same in all periods of the earth, is, I repeat, an unwarrantable hypothesis with no *á priori* probability, and only to be maintained by an appeal to geological phænomena.

"Each formation of geology may have required a very long period for its complete development; and of such an element as past time, we grudge no man the appropriation. But after all, the successive formations, about which we speculate, however complex in their subdivisions, are small in number: and after decyphering a series of monuments, we reach the dark ages of our history, when, having no longer any characters to guide us, we may indulge at will in the creations of our fancy. We may imagine indefinite cycles, and an indefinite succession of phænomena; and in the physical world, as well as in the moral, we may have our long periods of fabulous history. But these things belong not to inductive geology; and all I now contend for, is—that in the well established facts brought to light by our investigations, there is no such thing as an indefinite succession of phænomena.

"If the principles vindicated in Mr. Lyell's work be true, then there can be no great violations of continuity, either in the structure or position of our successive formations. But we know, that there are enormous violations of geological continuity; and though, relatively speaking, many of them may be local, of this at least we are certain, that they have been produced by forces adequate to the effects, and co-extensive with the phænomena.

"The very first step we take, we see a violation of continuity. Between the alluvial silt, deposited by the waters now flowing off from the inequalities of the earth, and the masses of diluvial gravel scattered over so many parts of its surface, we can seldom establish any appearance of continuity, or give any intelligible proof of their common origin. I am not going now to plunge into this long debated question; but I may remind you of the enormous waterworn blocks (derived from the primary chains to the north of the Baltic Sea), which lie scattered over the great European plain, extending from the eastern states of Holland to the Steppes of central Russia. Where are the inclined planes down which these boulders could have descended? Where are the grooves and channels cut out by the rivers which once propelled them? Where is the alluvial silt accumulated by the erosion of these ideal waters? No answer can be given to these questions; and to talk of river action, aided as it may have been by every ordinary power of nature, appears to me, in a case like this, little better than a mockery of my senses."

"If indeed we were to admit a period of intense volcanic violence, and a sudden elevation of the Scandinavian chain, we might then have a cause commensurate to the effects observed, and in the rush of the retiring waters, we might explain the transport of those great boulders which lie scattered over the northern plains of Europe. But in the speculations I am combating, all great epochs of elevation are systematically, and I think unfortunately, excluded. Volcanic action is essentially paroxysmal; yet Mr. Lyell will admit no greater paroxysms than we ourselves have witnessed—no periods of feverish spasmodic energy, during which the very frame-work of nature has been convulsed and torn asunder. The utmost movements that he allows are a slight quivering of her muscular integuments."

These objections to Mr. Lyell's theory are perhaps carried too far: he does not insist upon the absence of all violent paroxysms, so much as he labours to give due weight to the power of causes now in operation. The existence of a vast depression on the earth's surface, extending beyond the Caspian and the Aral, might be adduced as an illustration of great operations still working before our eyes; should any fissure be laid open by subterranean force, so as to connect this basin with the nearest ocean, we should suddenly witness a deluge, attended with proportionate convulsions, over a space ascertained by M. de Humboldt and Col. Monteith to extend over at least 18000 square leagues, reaching to Saratof Orenburg, and the low regions of the Oxus and the Jaxartes: the lowest level of this vast basin is 300 feet below the Mediterranean*.

Mr. R. J. Murchison, the present President of the Geological Society†, was a fellow labourer with Mr. Lyell, when his mind was first led to the line of investigation which he has since developed. It was in their tour along the southern shores of the Mediterranean, and subsequently in the north of Italy, that Mr. Lyell's attention was particularly directed to the distribution of the tertiary strata into new groups, according to the proportional number of shells identical with living species, found fossil in each formation: after examining the Sub-Apennine shells, he pursued his inquires in Naples and Sicily, where disturbing causes have been in continual action from remote antiquity, hoping to ascertain whether successive and distinct creations of organic remains might not have been elevated from beneath the sea, by a series of subterranean convulsions, continued from the period of the mixed Sub-Apennine deposits, uninterruptedly, to the historic æra. He here began to unfold the true papyri of geological history: in many mountains of considerable magnitude, the extinct species had nearly disappeared, and in other vast accumulations of fossil marine shells, nearly all were specifically identical with those now inhabiting the adjoining sea. Thus, by a series of deductions, he removed as arbitrary and untrue those lines of demarcation between what had termed the ancient and the existing orders of nature; and he had the satisfaction to find, that the same train had been developed by M. Desnoyers and M. Deshayes, from a close examination of the Paris basin.

* Professor Murchison's Address, 1832, Phil. Mag. lxv. p. 384.—Gl. in Sc. III. 330. The Academy of St. Petersburg, at the instigation of M. de Humboldt, is now engaged in directing surveys and barometrical "soundings," as they are emphatically styled, by which the precise extent, depths, and true shore of this dry Caspian will be accurately defined.

† Annual Address, 1832, Phil. Mag. lxv. 375.

Mr. Lyell has engaged the latter to co-operate with him in classing the tertiary formations chronologically, according to the relative number of existing species in each group. Their joint labours will form a most valuable "Manual of Fossil Conchology," which is announced as forthcoming in the third volume of Mr. Lyell's "Principles of Geology." It was subsequent to these studies that the latter author was prompted to continue his examination of the various causes still in operation on the surface of the globe, which form the subject of his second volume. In the former, we were presented with the effects of inorganic forces; in the second, we find an abundance of facts connected with the fluctuations in the organic world. So ample are the data in natural history, upon which the author has established his conclusions, that they cannot fail to relieve him from the charge of visionary speculation*.

Prof. Sedgwick felt alarmed, lest the gradual course of nature, upheld in the first volume, should favor the doctrine of spontaneous generation and transmutation of species, with all their train of monstrous consequences; but nothing can be fairer or more impartial than the manner in which the untenable parts of Lamarck's dogmas are refuted in the second volume, and the recent appearance of man upon our planet, satisfactorily confirmed.

Turning now from the view of gradual changes, upon which we have impartially quoted the opinions of an opponent and of an advocate, we come to the hypothesis of mundane convulsions, where, as might be expected, the late and the actual Presidents change sides. In the words of the former, the theory of M. Elie de Beaumont si thus described†:

"M. Elie de Beaumont, by an incredible number of well conducted observations of his own, combined with the best attested facts recorded by other observers, has proved, that whole mountain chains have been elevated at one geological period—that great physical regions have partaken of the same movement at the same time—and that these paroxysms of elevatory force have come into action at many successive periods. Distinguished as are his merits, he so far claims not an undivided honour. But in the next great step of generalization, he reaches a position where he stands entirely by himself.

"Step by step, we had been advancing towards the conclusion—that different mountain chains had been elevated at several distinct geological periods; and by a long series of independent observations, Humboldt, Von Buch, and other great physical geographers, had proved—that the mountain chains of Europe might be separated into three or four distinct systems; distinguished from each other, if I may so express myself, by a particular physiognomy, and, above all, by the different angles made by the bearings of their component formations with any assumed meridian. All the subordinate parts of any one system were shown to be parallel; while the different systems were inclined at various angles to each other.

"By an unlooked-for and most felicitous generalization, M. Elie de Beaumont has now proved, that these two great classes of facts are commensurate to each other; and that each of these great systems of mountain chains, marked on the map of Europe, by given parallel lines of direction, has also a given period of elevation, limited and defined by direct geological observations. The steps by which he reaches this noble generalization are so clear and convincing, as to be little short of physical demonstration. It forms an epoch in the history of our science; and I am using no terms of exaggeration when I say, that in reading the admirable researches of M. de Beaumont, I appeared to myself, page after page, to be ac-

* Phil. Mag. 377. † Anniversary Address, 1831.

quiring a new geological sense, and a new faculty of induction ; and I cannot express my feelings of regret, that during my recent visit to the Eastern Alps I did not possess this grand key to the mysteries of nature.

" I am aware how impossible it is in a few words to give any clear notion of a volume of condensed original researches. Dropping all minor details, I may, however, claim your indulgence, while I point out the author's manner of induction in four great systems of European chains : not indeed in the wish of quenching the curiosity of those who have not studied this question, but rather in the hope of urging them to seek the fountain of original information.

" 1. The first system includes the higher elevations, in eastern France, of the Côte d'Or and Mont Pilas, and a portion of the Jura chain. It may be traced towards the valley of the Rhine, where it is suddenly cut off ; but it re-appears in the chain of the Erzgebirge, between Bohemia and Saxony. It never rises into mountains of the first order, but is marked throughout (as may be seen on a good physical map) by many longitudinal ridges and furrows, ranging nearly parallel to each other, in a direction about north-east and south-west. So far the statement is only an enumeration of certain connected facts in physical geography. But it is followed by a co-ordinate series of geological phænomena.

" A number of formations, including in the ascending order the whole oolitic series, enter here and there into the composition of the geographical system above described ; and without exception, wherever they appear, all are in turn elevated, broken, or contorted; yet in their lines of range they preserve a parallelism to the general direction of the ridges. On the contrary, wherever rocks, of an age not older than that of the green-sand or chalk, appear in the vicinity of any portion of this system, they are either found at a dead level, and expanded from the neighbouring mountains into horizontal planes, like the sea at the base of a lofty cliff; or if, since their first deposit, they have undergone any great movement, it is shown to have no relation to the bearing of the older ridges, and to have been produced at a later period.

" From all these combined facts follow three important consequences : 1st. That the whole system of parallel ridges, from one end to the other, was elevated at the same period of time, after the development of the oolitic series, and before the deposition of the green-sand and chalk. 2ndly. That the action of elevation was violent, and of short continuance; for the inclined strata are shattered and contorted, and between them and the horizontal strata there is no intermediate gradation of deposits. 3rdly. That the period of elevation was followed by an immediate change in many of the forms of organic life.

" 2. The next great system includes the whole chain of the Pyrenees—the Northern Apennines—the calcareous chains to the north-east of the Adriatic—nearly the whole Carpathian chain—and a great series of inequalities, continued from that chain through the Hartz mountains, to the plains of Northern Germany. Through the whole of these vast regions the principal inequalities range nearly parallel to each other, and have a mean bearing about west-north-west and east-south-east. So far again the statement is purely geographical, and its truth is seen at once in glancing over any good physical map of Europe; and will be still more clearly comprehended, by comparing some of the principal ranges of colour on Von Buch's great geological map with the bearing of the Pyrenees. But it is followed by a series of co-extensive geological phænomena.

" Through all parts of this great system, formations of the age of the green-sand and chalk have had an enormous development, and without exception, their strata

are ruptured and contorted, and often lifted up to the very pinnacles of the mountains. But, on the contrary, wherever any tertiary formations approach the confines of this system, they are stated to be either in a position almost as horizontal as the surface of the waters in which they were deposited ; or if they have been moved at all, it is by forces uninfluenced by the parallels of the older chains. And the same three conclusions, with a mere difference of dates, follow here as in the former case. All the great parallel ridges and chains of this second system must have been suddenly and violently elevated, and at a period of time between the deposition of the chalk and the commencement of the tertiary groups ; and the corresponding change in organic types is, in this instance, still more striking than in the former.

" 3. The third system embraces a great number of parallel inequalities, bearing about north-north-east and west-south-west, and includes the whole Western Alps, from the neighbourhood of Marseilles to the volcanic ridges near the foot of the Lake of Constance. And by an hypothetical, but I think probable extension, it also takes in the whole of the great Scandinavian chain.

" I cannot enter on the elaborate and satisfactory details by which it is proved —that all these great parallel inequalities in the region of the Western Alps had their origin after the tertiary *molasse*, a deposit partaking of all the elevations and contortions of the older strata—that the elevatory movements were sudden and violent, and commenced at a time when tribes of mammalia (the remains of which in England are hardly ever found except in the superficial gravel) flourished in many parts of Europe—and that these movements were immediately succeeded by great horizontal deposits of old diluvial gravel at the base of the Western Alps, and probably also by that vast offshot of Scandinavian rocks which lie scattered over the northern plains of Germany.

" 4. The fourth system embraces many great parallel ridges, having a range about east-north-east and west-south-west, and includes several considerable chains in Provence, and nearly the whole chain of the Eastern Alps—from the great flexure in the region of Mont Blanc to the Alps of the states of Austria.

" It would be impossible to follow the author through details occupying a large portion of his volume. I may however state, that he proves the formations of the Eastern and Western Alps not to pass into each other by any flexure of the strata coinciding with the bend of the whole chain ; but to meet at an angle marked by a great double system of breaks and fissures, one passing in the direction of the eastern, and the other of the western, portions of the chain. He further proves, that the system of fissures in the line of the Eastern Alps is more recent than the other system—that in the prolongation of this line, towards the west, the old diluvial gravel has undergone movements of elevation—and that these movements have been propagated to the lacustrine and volcanic regions of Auvergne.

" On a review of the whole evidence, I think he has demonstrated, that there are two distinct deposits of diluvial gravel near a portion of the Western Alps—that the colossal mass of Mont Blanc, and at least a considerable portion of the Eastern Alps, were elevated after the deposit of the older dilivium—and that the newer diluvium (including all those enormous crystalline erratic blocks so admirably described by Saussure) rolled off from the regions of the higher Alps during this last period of their elevation.

" There are six other supposed periods of elevation briefly considered in the researches of M. Elie de Beaumont, each marked by distinct geographical features : but I will not now detain you with their enumeration. If the generalizations to

which I have pointed be true, (and as far as I comprehend them, they seem to be based on an immovable mass of evidence,) we must then conclude that there have been in the history of the earth long periods of comparative repose, during which the sedimentary deposits went on in regular continuity, and comparatively short periods of violence and revolution, during which that continuity was broken. And if we admit, that the higher regions of the globe have been raised from the sea by any modification of volcanic force, we must then also admit that there have been several successive periods of extraordinary volcanic energy.

"How we are to escape from this conclusion I am unable to comprehend, unless we shut out the evidence of our senses. Of volcanic powers we know nothing, except during the irregular periods of their activity—and returning periods of intense activity, after long ages of comparative repose, may be among the enduring principles in the mechanism of nature. I do not throw this out as even a probable hypothesis: but it is, at least, as probable as any other hypothesis unfounded on the evidence of geological phænomena.

"That the system of M. Elie de Beaumont is directly opposed to a fundamental principle, vindicated by Mr. Lyell, cannot admit of doubt. And I have decided to the best of my judgement, in favour of the former author, because his conclusions are not based upon any *a priori* reasoning, but on the evidence of facts; and also, because, in part, they are in accordance with my own observations*."

Mr. Boué and other able writers have opposed the views of this eminent geologist; they deny him the merit of being the first to point out, that different formations and masses of land have been elevated at distant and separate periods, and reject that part of his system which asserts the synchronous elevation of distant mountain chains parallel to each other. Before we are warranted in arriving at general conclusions on this latter point, numerous facts must be collected, and we can but urge all our working brethren to try the adequacy of M. de Beaumont's ingenious theory, by an appeal to nature†; M. de Humboldt believes, that the four great chains of Asiatic mountains are parallel to one another, and that circumstance tends powerfully to confirm the theory. As however, the personal observations of this traveller have not extended beyond the Altai, we must still look for evidence whereon the synchronism of the elevations of these mountains may rest to our Indian geologists, whose exertions will naturally be stimulated to attempt the solution of the problem. Russia has been before hand with us in exploring their newly acquired portion of Asia; their government, with its characteristic enterprize, being desirous of acquiring accurate information respecting the structure, natural history, and heights of the Caucasus, sent hither in the summer of 1829, under a strong escort, commanded by General Emanuel, a party of men of science, the chief of whom, M. Kupfer, has given in his report to the Academy of Sciences of St. Petersburg.

* "For example, the vertical position of the green-sand and chalk on the eastern flank of the Hartz mountains, and the horizontal position of the same formations on the flanks of the Erzgebirge, were remarked by Mr. Murchison and myself, in the summer of 1829. During the same tour, we had repeated proofs of the recent elevation of the chain of the Eastern Alps; of the high elevation of the green-sand series in the calcareous chain to the north-east of Trieste; and of the horizontality of the tertiary deposits of Styria. All these facts (of which we did not at the time comprehend the whole importance), harmonize with the system of M. de Beaumont."

† Address, 383.

From the geographical and geological chapters of this interesting report, we learn, that the low hills, which rise above the Steppes of the Black Sea and Sea of Azof, are composed of limestone, filled with littoral shells, the collections of which made by M. Pander, on this and a former occasion, must prove of great geological importance. On ascending from the Steppes towards the Caucasus, grits and older limestones, with ammonites, occupy an undulating country, diversified by several peaks of trachyte, the principal of which, the *Bechtan*, or five mountains, is stated to be 4000 feet above the sea. The outer zone of the Caucasus is described as being a rugged and lofty plateau from 8000 to 9000 feet above the sea, the strata of which present tabular summits, chiefly composed of calcareous grit and conglomerates nearly horizontal, or rising at only a gentle angle towards the central ridge. This table land is figured by deep transverse rents, in which the rivers flow; and one of the lowest formations is a limestone, which the author compares with the *calcaire à gryphites.* These secondary strata are separated from the central mountains by a band of transition and old slaty rocks, which have been dislocated by the contact of certain green stones and basalts. The loftiest part of the central chain, culminating in the double peak of Mount Elborz, at the height of 15,400 French feet above the Black Sea, is entirely of igneous origin, being principally composed of a dark-coloured porphyritic trachyte. The volcanic rocks of this region are shown to be of considerable antiquity, because the secondary deposits rest upon them in undisturbed positions, the transition formations having alone been dislocated*.

It did not come within our purpose to particularize any practical geological researches, but we have digressed in this case, because the ground trodden is closely connected with our own Asiatic field, and it may act as an useful stimulus to point out what our neighbours are about. The Court of Directors have appointed to Madras an eminent geologist, Dr. Turnbull Christie†, of whose researches in Sicily, the President of the Geological Society speaks in high terms; to him, we look with great expectation, when he enters the vast field, hitherto but partially visited by Voysey and Dangerfield.

But to continue our review of Theoretical Geology:—the phenomena of *thermal springs* have been attributed by Dr. Daubeny to volcanic agency, whether they issue from the neighbourhood of action and extinct foci of eruption, or upon linear fissures and dislocations of the ancient strata, produced by expansive forces during former periods of elevation; in fact, the evolution of gases and increased temperature of springs may be looked upon as proofs of the presence of volcanic action still in force, with as much propriety as eruptions of lava and shocks of earthquakes. Having detected the presence of nitrogen gas in thermal waters, he concludes, that the chemical theory of the origin of volcanoes is still to be maintained, as being more philosophical, and more consistent with facts and experiments, than the hypothesis of a central ignited fluid, which has been from time to time mechanically forced up to the surface of the earth.

The question of the increase of the temperature of the ground, in descending to great depths, still rests upon uncertain data. As far as experiments upon mines and artesian springs have been carried (by M. Cordier in particular), the results

* Murchison's Address, Phil. Mag. lxv. 385.

† Since the above was written the death of this meritorious and able officer has been announced! He was on his way to the Nilgiri Hills, which he proposed to explore with care, where he was attacked by jungle fever to which he fell a victim in a few days.

are uniformly favorable to such a theory—on the sea they are as steadily opposed to it; observations of the temperature of springs in all parts of the world are invited to solve this question*.

It is now generally acknowledged, that the formation called *diluvial gravel*, and supposed to have reference to the epoch of the deluge, is not the result of one, but of many successive periods. The essays of M. Beaumont have established this point beyond dispute, although it militates against opinions, but a few years since held almost universally as indisputable.

"We now connect the gravel of the plains with the elevation of the nearest system of mountains; we believe that the Scandinavian boulders in the north of Germany are of an older date than the diluvium of the Danube; and we can prove that the great erratic blocks, derived from the granite of Mount Blanc, are of a more recent origin than the old gravel in the tributary valleys of the Rhone.

"Theories of diluvial gravel, like all other ardent generalizations of an advancing science, must ever be regarded but as shifting hypotheses to be modified by every new fact, till at length they become accordant with all the phænomena of nature.

"In retreating where we have advanced too far, there is neither compromise of dignity nor loss of strength; for in doing this, we partake but of the common fortune of every one who enters on a field of investigation like our own. All the noble generalizations of Cuvier, and all the beautiful discoveries of Buckland, as far as they are the results of fair induction, will ever remain unshaken by the progress of discovery. It is only to theoretical opinions that my remarks have any application.

"Different formations of solid rock, however elevated and contorted, can never become entirely mixed together; and the very progress of degradation commonly lays bare all the elements of their structure. But diluvial gravel may be shot off from the flanks of a mountain chain, during one period of elevation, and become so confounded with the detritus of another period, that no power on earth can separate them: and every subsequent movement, whether produced by land floods or any other similar cause, must continually tend still further to mingle and confound them. The study of diluvial gravel is, then, not only one of great interest, but of peculiar difficulty and nice discrimination; and in the very same deposit, we may find the remains of animals which have lived during different epochs in the history of the earth.

"Bearing upon this difficult question, there is, I think, one great negative conclusion now incontestably established—that the vast masses of diluvial gravel, scattered almost over the surface of the earth, do not belong to one violent and transitory period. It was indeed a most unwarranted conclusion, when we assumed the contemporaneity of all the superficial gravel on the earth. We saw the clearest traces of diluvial action, and we had, in the Mosaic history, the record of a general deluge. On this double testimony it was, that we gave a unity to a vast

* The prevailing practice of boring for water affords an easy method of ascertaining the temperature of the ground of different depths, free from the dubious results of mines:—thus Magnus has found from borings near Berlin, the temperature of the air being 49° 1′ the heat of the ground was as follows:

at 675 feet, temperature	67.7,	giving for one degree,	36.3 feet.
516 do.	63.9,		34.7 do.
392 do.	62.8,		28.5 do.

succession of phænomena, not one of which we perfectly comprehended, and under the name diluvium, classed them all together.

"To seek the light of physical truth by reasoning of this kind, is, in the language of Bacon, to seek the living among the dead, and will ever end in erroneous induction. Our errors were, however, natural, and of the same kind which led many excellent observers of a former century to refer all the secondary formations of geology to the Noachian deluge. Having been myself a believer, and, to the best of my power, a propagator of what I now regard as a philosophic heresy, and having more than once been quoted for opinions I do not now maintain, I think it right, as one of my last acts before I quit this chair, thus publicly to read my recantation.

"We ought, indeed, to have paused before we first adopted the diluvian theory, and referred all our old superficial gravel to the action of the Mosaic flood. For of man, and the works of his hands, we have not yet found a single trace among the remnants of a former world entombed in these ancient deposits. In classing together distant unknown formations under one name; in giving them a simultaneous origin, and in determining their date, not by the organic remains we had discovered, but by those we expected hypothetically hereafter to discover, in them; we have given one more example of the passion with which the mind fastens upon general conclusions, and of the readiness with which it leaves the consideration of unconnected truths.

"Are then the facts of our science opposed to the sacred records? and do we deny the reality of a historic deluge? I utterly reject such an inference. Moral and physical truth may partake of a common essence, but as far as we are concerned their foundations are independent, and have not one common element. And in the narrations of a great fatal catastrophe, handed down to us, not in our sacred books only, but in the traditions of all nations, there is not a word to justify us in looking to any mere physical monuments as the intelligible records of that event: such monuments, at least, have not yet been found, and it is not perhaps intended that they ever should be found. If however, we should hereafter discover the skeletons of ancient tribes,, and the works of ancient art buried in the superficial detritus of any large region of the earth; then, and not till then, we may speculate about their stature, and their manners, and their numbers, as we now speculate among the disinterred ruins of an ancient city*."

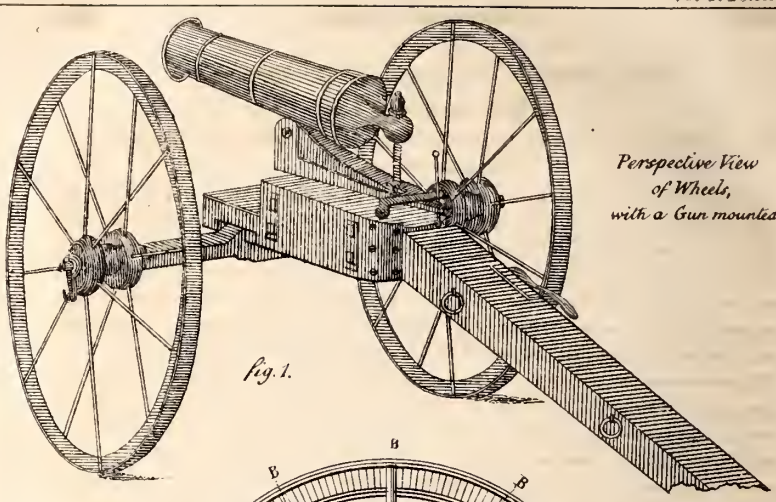
After learning, that so important a change has been effected in the nomenclature of geological formations, we cannot conclude the present compilation better than by presenting our readers with a comparative view of the classification of rocks, according to all the current systems, extracted from the excellent Manual of Geology recently published by Mr. De la Beche, a work which compresses into the most portable form the whole data of Geological Science, and on which Mr. Murchison passes the following encomium:

"Nothing short of this compendious and instructive digest, in which without losing sight of general principles the author has endeavoured to adhere to the impartial rule of *suum cuique* was to have been expected from the pen of so experienced and acute a geologist; and so eager is the demand of the public for a really good work on this subject, that a second edition has been called for, and is already published†."

* Rev. Prof. Sedgwick's Address, Phil. Mag. 314.

† Murchison's Address, Phil. Mag. lxv. 374.

		De la Beche.	*Improved Wernerian.*	*Conybeare.*	*Omalius d' Halloy,* 1830.	*Brongniart,* 1829.	
Stratified Rocks.	Superior Stratified, or Fossiliferous.	1. Modern Group. Detritus of various kinds produced by causes now in action; Coral islands; Travertino, &c.	Alluvion..	.....	.....	Alluvial and Lysian rocks.	Jovian Period.
			.....	.....	.....	Clysmian rocks.	
		2. Erratic Block Group. Transported boulders and blocks; gravels on hills and plains, apparently produced by greater forces than those now in action.	Diluvium: Ancient Alluvion.	Superior Order.	Tertiary rocks.	Secondary.	
		3. Supercretaceous Group. Various deposits above the chalk, such as, in England, the Crag, Isle of Wight beds, London and Plastic clays. In France, the freshwater and marine rocks of Paris, &c.	Tertiary..	.....	.....		
		4. Cretaceous Group. 1. Chalk. 2. Upper green-sand. 3. Gault. 4. Lower green-sand. To which may be added, for convenience, 1. Weald clay. 2. Hastings sands. 3. Purbeck beds.	Secondary	Supermedial Order.	Ammonean rocks.		Saturnian Period.
		5. Oolitic Group. The rocks usually known as the Oolite formation, including the Lias.				Izemian rocks.	
		6. Red Sandstone Group. 1. Variegated or Red marl. 2. Muschelkalk. 3. Red sandstone. 4. Zechstein; and 5. Red conglomerate.					
		7. Carboniferous Group. 1. Coal measures. 2. Carboniferous limestone. 3. Old red sandstone.	.....	Medial.	.....		
		8. Grauwacke Group. Grauwacke, thick-bedded and schistose, sometimes red; Grauwacke limestones; Grauwacke clay slates, &c.	Transition.	Submedial Order.	Hemilysian rocks.	Hemilysian rocks.	
		9. Lowest Fossiliferous Group. Various slates, frequently mixed with stratified compounds resembling those of the unstratified rocks.	.....	.....	.....		
	Inferior Stratified, or Non-Fossiliferous.	No determinate order of superposition. Various schistose rocks, and many crystalline stratified compounds, such as Gneiss, Protogine, &c.	Primitive, or Primary.	Inferior Order.	.....	Agalysian rocks.	
Unstratified Rocks.		Volcanic, Trappean, Serpentinous, and Granitic rocks. Ancient and modern Lava, Trachyte, Basalt, Green-stone, Corneans, Augite & Hornblende Porphyries, Serpentine, Diallage rock, Sienite, Quartziferous Porphyry, Granite, &c.	Arranged among the stratified rocks, according to the order in which they are supposed to occur.	The same as the improved Wernerian.	Pyroidal & Agalysian rocks.	Primordial.	Modern volcanic rocks, classed as pyrogeneous rocks; igneous rocks of an older date, as Typhonian.



Perspective View of Wheels, with a Gun mounted.

fig. 1.

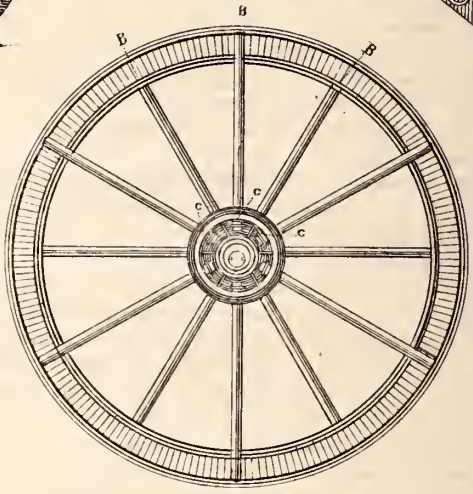
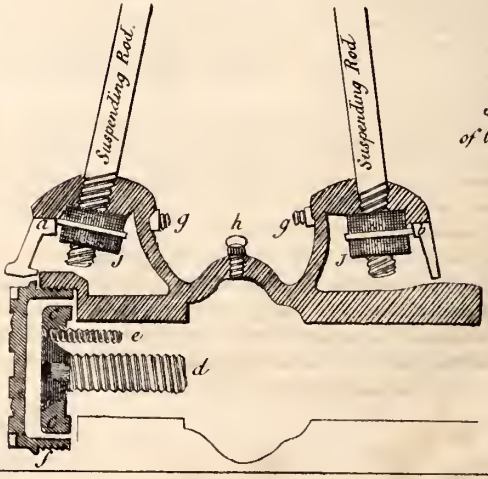


fig 2.

Front View with the Shield of the Nave.



Section of the Nave.

fig 3.

XI.—Progress of Mechanical Science.

2. *Iron Suspension Wheels.*

[Note accompanying the model presented to the Asiatic Society, by Lieut.-Colonel Watson, 3rd Oct.]

A description of the great improvement in the construction and principle of wheels for carriages of all sorts lately introduced by Mr. Theodore Jones, will be found in most of the journals of mechanical inventions at home; but as such works are not frequently to be met with in India, I will commence by explaining the nature of this invention in the words of a small pamphlet, published by the patentee, referring the reader to the accompanying plate in explanation, or those who are in Calcutta, to the model deposited in the rooms of the Asiatic Society.

"The construction of Messrs. Jones & Co.'s wheels is upon a new principle, that of suspension. In the old wheels, those spokes, which are under the nave, support the weight; in these it is jointly sustained by rods depending from the upper part of the felloe, as will be seen in the plate, fig. 1. The rod or spoke is made thick at the outer end, so as to be drawn firmly into a conical hole, bored from the outside of the felloe, and the nave depends from the rods, being sustained by nuts and screws within the cells, fig. 2. The advantage of this principle is, that it gives an elasticity to the lower part of the periphery of the wheel, which, while it diminishes the draught, is less wear to the road.

An aperture, in which there is a thumbscrew, is made into the centre of the nave, where the oil cell is, and by which it is replenished, without taking the wheel off the axle. The cell contains enough oil to serve the wheel in work for five or six weeks.

The Patent wrought-iron wheels are made either cylindrical, conical, or dishing, and are either sold with the improved axles, or may be fitted to any others.

Fig. 1 of the accompanying plate exhibits a perspective view of the wheels applied to a gun-carriage. Fig. 2 is an elevation of the same, with the ring of the nave open, to show the nuts of the suspension bars: their construction is more fully shewn in fig. 3 wherein *a*, *b*, are the front and back shields; *c*, a collet on the nose of the axle; *d*, a screw with conical head, which passes through the collet, and fastens it to the axle; *e*, a small screw through the side of *d*; *f*, a collar on the cap, which presses against a leather-washer, to prevent the oil escaping in front; *gg*, small bolts, which keep the shields in their places; *h*, a thumb-screw, where oil is to be supplied; *jj*, the nuts which are screwed on the end of the rods (or spokes) in the nave. The cap (in front of the nave) must be taken off, when the wheel is to be put upon the axle, in order to fasten the *collet* in its place, which is a substitute for a linch-pin.

If the suspending rods of the wheels by any means become slack, each of the nuts must be screwed up (equally), which is done better by giving the head of the rod a blow with a hammer, and turning the nut at the same instant, taking care when done, that each nut presents one of its flat sides in front for the shield to press against, which will prevent the nuts unscrewing."

I shall beg leave now to offer a few remarks on the appearance, durability, strength, efficiency, and comparative economy of the suspension wheels, and to publish, for the satisfaction of those, who wisely wait for the actual trial of an invention, before determining in its favor, the result of some experiments made by order of the Court of Directors, who have in consequence determined on a more extensive trial of the wheels by their ordnance department in India.

The iron wheel, though the same weight, or lighter than the common one in use, is incomparably lighter and more elegant in appearance: to give sufficient strength to wooden wheels, particularly in this country, they require to be made proportionally clumsy; this is particularly observable in the naves which exhibit an unseemly conical block, so shaped to admit of the hoops being from time to time driven home, as the wood shrinks, in the nave of the iron wheel no such deformity is presented.

The material, being iron throughout, is not affected by the atmosphere, which in India is found so destructive to wood, causing the necessity of frequent setting up and constantly recurring outlay for repairs: even new wheels kept 12 months in store, require to be set up before being brought into use, or sent on service. The tire of the iron wheel is so firmly united to the nave, by the suspending rods or spokes, that no working can loosen it—a defect wooden wheels are at all times, and in all places, subject to. The tire or rim of the patent wheel is the only part liable to wear out; when this takes place to a certain extent, fresh tires may be applied, as in common wheels; such tires being put on at a red heat, over the cold rim, grasp it by the contraction that takes place in the process of cooling; almost as firmly as if the parts were welded together. By this simple and expeditious operation, a wheel after 20 or 30 years' service may be put in condition to perform as many more, with this difference however that the spokes are no longer capable of being removed at pleasure, the heads being covered by the new tire; but this can be of little consequence, as such repaired wheels might be appropriated to waggons or other carriages not usually exposed in action, or it might be found advantageous to withdraw the old spokes before applying the new tire, and then to drill fresh holes for a new set of spokes, or for the old ones, with heads readjusted to fit the holes, and thus a complete new wheel would be produced. These wheels are not liable to injury from any concussion, however violent, because they yield to a certain extent to the shock, space sufficient being left, within the cells of the nave to admit of a recoil or spring of the tire by the slight and simultaneous insertion or penetration of the nutted ends of the spokes to the interior surface of those cells.

The strength of the patent wheel is in proportion to the power of the rods forming the spokes to suspend a weight; these spokes not only operate in bearing the weight with which the wheels are loaded, but in binding and keeping the whole together, each acting with its opponent in suspending the nave from the rim. In common wheels, the spokes contribute little or nothing in binding the parts together, which depends solely on the tire; so that the fracture or relaxation of this, whilst the wheel is in motion, would necessarily cause the separation of all the parts. This disruption and consequent breaking down could not possibly take place in the patent wheel, even though the rim were completely severed by a cannon shot. Such was actually the case in the experiments lately tried at Woolwich, and yet the wounded wheel, which had been placed before the butt, was put on to the axle of the gun, and employed to carry it out of the field, whilst the wooden one which had been struck by the shot exactly in the same manner, was left in scattered fragments on the ground. The little model brought out by me sustained with ease 14 cwt., and might safely be loaded with a ton, and from hence a calculation may be made of the great strength of the full-sized wheels.

After an engagement, or during an action, the patent wheel may be repaired in a few minutes, in case of some of the spokes being shot away, by the introduction of fresh ones; whilst in such case the common wheel would be rendered

unserviceable: in the former, if even half of the spokes remained, the wheel would continue serviceable—not so the other. It would be superfluous to dwell on the vast advantages which might arise from the being able to keep a gun in action that in ordinary circumstances would be disabled. The iron wheel, if struck by a cannon shot, will not splinter. The trial that took place at Woolwich fully establishes this important fact. Iron wheels may be considered proof against musquetry, if not against grape. Iron wheels will need no repair over rough ground, or stony roads, or from concussions; hence forge establishments with field or battering rams may be greatly diminished, if not dispensed with altogether on this account. In support of the general efficiency of iron wheels, in constant employment for years in drags and heavy carriages of all descriptions, on the paved streets of London, reference can be had to the certificates of many of the principal brewers, builders, and practical engineers of the metropolis. The draught of the patent wheels has been ascertained to be one-fourth lighter than that of the common wheels—three horses performing the work of four.

The first cost of the patent wheels, deliverable in London, is as follows, each being 4 feet eight inches high.

1st, with tire,	3 inches wide,	£18	per pair.
2nd, do.	4½ do.	20	do.
3rd,	6 do.	25	do.

To this must be added the amount of freight from Europe, about £4 per ton. I am not exactly aware of the cost of wheels made at the Gun Carriage Agency, but according to General Hardwicke's statement, it appears fully to equal, if not to exceed, the above; but the great economy that would attend the introduction of iron wheels into the service would result from the abolition of expensive establishments kept up to supply or repair wheels not fairly worn out by service, but decayed or shrunk from exposure to the vicissitudes of alternate heat and moisture. I am not prepared to point out the various particulars in which retrenchment might be made; but it is evident, that repairs would require but little; that less than a third of the sum at present allowed for tar and grease would be more than sufficient for oil for the patent wheels; that less than half the quantity of paint would be required, and that every part of a condemned iron wheel would be worth half of its original cost, whilst the condemned parts of wooden wheels, except the iron work, are only fit for fire-wood. On this point of economy, I may quote the substance of a letter addressed by Messrs. Whitbread and Co. to the Secretary of the Honourable East India Company.

"At the request of Messrs. Theodore Jones and Co. the proprietors of the iron wheels, we beg to state to you, that the saving we have effected, in consequence of the use of iron wheels, amounts to more than £180 per annum on 35 pair of wheels. We take this opportunity of expressing our approbation of the invention in every respect. WHITBREAD AND Co."

With reference to this letter, which was delivered by General Hardwicke to the Secretary, it need hardly be observed, that if a single house of business obtained so large a saving on 35 pair of wheels, the subject must be of immense importance to the Hon'ble Company, as their saving would not only be great in proportion to the number of wheels in the service, but also on account of the unfavourable influence of climate on wooden wheels.

The above remarks are fully corroborated by the following Report of experiments made with the new wheels, under the superintendence of Major-General Hardwicke

and Lieutenant-Colonel Forrest, extracted from a lithographed circular, published by the Honorable Court, dated October 19, 1831.

Wheels tried.					
Size.	Height and Width of Tire.	Nature of Gun and Carriage.	Charges.	Rounds fired.	Remarks.
24 or 18 pdr.	Height, 5 feet,	24 pdr. Iron,	8 lbs.	3	The distance of the Guns from the Butt was about 35 yards.
	Width of Tire, 6 in.	Weight, 50 1 25 (cwt. qr. lbs.) Ditto of Carriage, 0 0 0			
12 or 6 pdr.	Height, 5 feet,	12 pdr. Brass,	8 ,,	3	
	Width of Tire, 3 in.	Weight, 18 0 5 (cwt. qr. lbs.) Ditto of Carriage, 0 0 0			

The experiments commenced with an iron 24-pounder gun and a brass 12-pounder, mounted on travelling field carriages, and their limbers: to the 24-pounder carriage was fitted a pair of the patent wrought iron wheels; to the limber, their own wood wheels were used.

The 12-pounder was equipped in the same manner, and provided with a draft of four horses. The 24-pounder with 6. Thus prepared, both were trotted at a brisk pace, and sometimes gallopped along a very rough pavement for about an hour; the wheels could not have been submitted to trial of strength more severe, some of the hollows in this pavement caused the carriages to bound from stone to stone to the extent of some feet, and the violence was so great as to break the rope lashings used to keep the guns in their places on their carriages, and the 12-pounder carriage was jerked completely off its limber.

On examination of the iron wheels after this trial, without removing them from the axle, no mark of injury was perceptible, nor a joint started: the wheels of the limbers which were wood did not resist the shaking so well, although they had only the weight of the empty limber boxes to carry; several spokes were started more or less from their sockets, one of the openings measured 3-16ths of an inch in width.—It may be observed, these were wheels never before used, and as they had lain several years in store, it is less to be wondered at that the wood had shrunk from the original joinings.

The next experiment was to drag the 24-pounder through marshy ground, with a weight altogether of from 4 to 5 tons, of which the limber wheels had comparatively nothing to carry, say about a 20th part of the weight.—It was started with a draft of six horses, but the weight sunk too deep for that number to drag it out, and the horses were sinking up to their knees; two more were then added, but while stopping the wheels of the carriage had sunk to a depth of 14 inches, and it required the exertions of half a dozen men in addition to set it in motion.

This experiment ought to have been begun with 10 horses, at least eight is the proper number allowed by the Regulations of H. M. service, for a 12-pounder weighing about 18 cwt.—It was therefore not to be expected, that the same number should drag through such a marsh, a load of 50-cwt. exclusive of the weight of the carriage.

This trial was not quite as conclusive as could have been desired, yet it was evident, that had the proper number of horses been given in the outset, the iron wheels would have cut their way through the swamp without a halt, but whether with the same ease as a wooden wheel, remains to be tried.——The 6-inch rim iron wheel has a tendency to sink into and plough up the soft ground, which adheres to the inner part of the rim, and accumulates, an additional weight being thus added to the wheel.—It is however to be remarked, that this objection applies only in very soft ground.

Two 12-pounders were next dragged through the same marsh. One mounted on patent iron wheels, the other on wood, and the draft applied was four horses to each (half the proper number) ; both moved through without stopping, but the draft was evidently difficult to both.—It was observed, that the iron wheels with 3-inch tire, did not collect earth about the rim as a 6-inch tire does when moving through soft ground.

The 24 and 12-pounder. were next placed in battery in front of the earthen butt, and from each gun were fired three rounds with full service charges (shotted one to each)—no visible effect was produced by this discharge.

To learn what would be the effect of a cannon ball fired at one of the patent iron wheels, one wheel was placed in front of the butt : the first discharge from the 12-pounder in the battery disabled two spokes. They were struck in an oblique direction, and the ball cut them as smooth as if it had been done with a sharp cutting instrument, bending both to one side, but without a fracture or fragment flying off.

The second shot was directed to the face of the rim, which broke it, and bent one end inwards ; one spoke was also cut through the nave, was grazed on the under side, one end of the nave box cracked, and a small piece cut off the opposite side of the rim.

The effect produced on the wood wheels differed very materially, the first shot from the same gun shattered two spokes, the splinters from which spread much.

A second shot was then fired at the wood wheel, placed with the face of the tire inclined to the front : the shot struck the tire a little below the centre of the nave, shivered it to pieces, and scattered the numerous fragments of the shattered wheel in all directions, some to a considerable distance.—This wheel was no longer repairable.

From the foregoing experiments, it is but justice to the patentees of the iron wheels to record the advantage under which they appear.

First. They are stronger and not so easily disabled in action, and when struck with a cannon ball, do not splinter.

Secondly. When they sustain an injury to the extent of two or three spokes broken, the wheel might be continued in use till an opportunity occurred of repairing it ; while a wooden wheel under similar circumstances would for the time be unserviceable.

Thirdly. The iron wheels are not subject to those changes which influence of climate and changes of seasons work on wood wheels—we have seen in the course of these experiments, that new wheels, that have lain a few years in store, would require to be set up before sent on service ; no length of time can render that necessary with the wrought-iron wheels.

Under all these circumstances, we are of opinion, that the trial, which has been made at Woolwich of the iron wheels, has been sufficiently satisfactory to warrant a hope, that the further and more extensive experiments, which the Bengal Government will be enabled to made, under all the vicissitudes of Indian climate, will bring their advantages fully to the notice of the Honourable Court.

The battery experiments were obligingly and ably assisted by the exertions of Captain Rawnsley, of the Royal Artillery, who superintended laying the guns, and which was done with an accuracy and effect hardly to be exceeded, and on the present occasion was all that could be wished for.

(Signed) Thomas Hardwicke, *Major-General.*

(Signed) W. Forrest, *Lieut.-Colonel.*

Meteorological Register, kept at the Surveyor General's Office, Calcutta, for the Month of November. 1832.

Days of the Month.	Minimum Temperature observed at sunrise.					Maximum Pressure observed at 9h. 50m.					Max. Temp. and Dryness observed 2h. 40m.					Minimum Pressure observed at 4h. 0m.					Observations made at sunset.					Observations at 10½ P. M. in Calcutta.					Rain Gauge, No. 1.	Rain Gauge, No. 2.
	Barometer reduced to 32°.	Temper. of the air.	Depres. of M. B. Ther.	Wind.	Aspect of the sky.	Barom. red. to 32°.	Temper. of the air.	Depres. of M. B. Ther.	Wind.	Aspect of the sky.	Barom. red. to 32°.	Temper. of the air.	Depres. of M. B. Ther.	Wind.	Aspect of the sky.	Barom. red. to 32°.	Temper. of the air.	Depres. of M. B. Ther.	Wind.	Aspect of the sky.	Barom. red. to 32°.	Temper. of the air.	Depres. of M. B. Ther.	Wind.	Aspect of the sky.	Barom. red. to 32°.	Temper. of the air.	Depres. of M. B. Ther.	Wind.	Aspect of the sky.		
1	29,861	73,	0,8	n. e.	m.	,976	76,3	2,1	n. e.	cis.	,786	76,5	3,3	n. e.	cis.	,784	75,5	2,8	n. e.	cis.	,787	74,5	2,8	n. e.	cis.	,852	73,8	1,8	n. e.	rn.	1,46	1,38
2	,838	70,5	1,3	do.	do.	,905	76,3	2,8	do.	cu.	,784	78,	4,1	do.	cus.	,787	77,3	3,3	do.	do.	,788	76,	2,8	do.	do.	,858	77,1	3,4	n. w.	cis.		
3	,849	71,	3,8	do.	cl.	,911	77,7	7,	do.	do.	,810	84,	12,	n.	cl.	,810	82,5	11,	n.	cl.	,824	78,5	8,3	cm.	cl.	,907	75,8	6,8	do.	cl.		
4	,885	66,	0,8	cm.	do.	,935	77,7	7,5	w.	cl.	,840	85,3	13,8	do.	do.	,828	83,5	10,8	do.	do.	,843	79,5	6,8	do.	do.	,920	74,2	3,8	s. w.	do.		
5	,893	68,	1,3	n.	do.	,961	80,	6,1	n. w.	do.	,868	85,3	11,8	do.	do.	,868	83,5	11,3	do.	do.	,889	79,5	6,3	do.	do.	,956	76,3	5,3	n. w.	do.		
6	,938	70,	2,3	do.	do.	,026	79,5	7,	n.	do.	,933	83,5	12,3	n. w.	do.	,934	82,5	12,	n. w.	do.	,935	79,	7,8	do.	do.	,019	76,0	7,0	do.	do.		
7	,007	68,5	2,8	cm.	do.	,056	77,5	9,3	do.	do.	,941	83,5	14,	do.	do.	,939	82,	12,5	do.	do.	,958	77,	7,8	do.	do.	,036	74,0	7,5	do.	do.		
8	,010	67,	1,8	do.	do.	,052	78,	7,5	n. w.	do.	,950	82,8	12,6	w.	do.	,948	80,5	11,8	w.	do.	,952	76,	6,5	do.	do.	,023	74,3	9,7	do.	do.		
9	,009	66,7	1,7	do.	do.	,041	78,3	8,3	n.	do.	,924	82,	12,3	do.	cu.	,929	81,	11,	n.	do.	,938	77,7	7,5	do.	do.	,013	74,4	6,4	s. w.	do.		
10	,009	66,	2,3	do.	do.	,042	79,8	9,9	n. e.	do.	,956	83,	12,5	n. w.	do.	,955	81,7	11,2	n. w.	do.	,956	78,5	7,8	do.	do.	,021	73,8	5,4	w.	do.		
11	,021	65,5	1,6	do.	do.	,093	78,5	9,	n.	do.	,958	83,	11,8	n.	cl.	,970	82,	10,8	n.	do.	,980	77,	5,3	do.	do.	,058	76,8	6,3	cm.	do.		
12	,037	68,	2,1	do.	do.	,093	77,7	6,8	w.	do.	,980	84,5	10,3	do.	do.	,978	82,5	10,3	do.	ci.	,000	79,	6,3	do.	ci.	,055	72,2	2,2	s.	do.		
13	,045	67,5	1,3	do.	do.	,104	79,	5,8	s. w.	ci.	,013	82,3	7,8	n. w.	cu.	,008	81,8	7,6	n. w.	cu.	,013	78,3	4,1	do.	do.	,043	74,0	4,6	do.	do.		
14	,027	66,5	1,	do.	do.	,090	80,	2,1	n. e.	do.	,975	83,7	16,2	do.	cl.	,975	80,7	13,	do.	cl.	,982	76,	6,8	do.	cl.	,037	73,3	5,0	cm.	do.		
15	,031	64,5	2,8	do.	do.	,098	75,5	1,	do.	do.	,986	82,	13,5	do.	do.	,985	80,3	13,3	do.	do.	,993	76,5	10,8	do.	ci.	,071	71,3	4,9	do.	do.		
16	,041	61,	1,8	do.	do.	,091	73,5	8,8	n. w.	cl.	,986	79,5	11,6	do.	do.	,986	78,3	10,6	do.	do.	,993	74,5	8,3	n. w.	cl.	,044	69,4	5,0	n. w.	do.		
17	,030	59,7	1,2	do.	do.	,092	74,5	9,	n.	do.	,979	79,3	13,1	n.	do.	,979	78,	13,3	do.	do.	,992	74,7	10,2	do.	do.	,042	69,8	5,6	do.	do.		
18	,001	61,3	3,1	do.	do.	,074	72,5	7,8	do.	do.	,950	79,5	12,	n. e.	do.	,948	77,7	10,5	n. e.	do.	,955	74,3	7,3	cm.	do.	,023	71,0	6,6	n. e.	do.		
19	,011	61,5	2,8	do.	do.	,063	74,5	7,3	n. e.	do.	,959	79,5	9,8	w.	cu.	,969	77,5	7,8	do.	cu.	,970	73,5	4,	do.	do.	,064	72,0	3,9	n. w.	do.		
20	,054	61,7	2,	do.	do.	,129	73,	7,8	do.	do.	,017	80,	12,8	n.	cl.	,008	79,	12,3	n.	cl.	,010	75,7	9,	do.	do.	,081	70,0	2,8	do.	do.		
21	,082	62,7	3,	do.	do.	,118	75,	7,5	do.	do.	,995	80,5	11,8	n. e.	do.	,990	78,7	10,5	n. e.	do.	,997	74,3	5,3	do.	do.	,053	70,8	2,4	do.	do.		
22	,043	61,7	1,5	do.	do.	,089	73,	4,8	do.	do.	,984	80,5	13,	do.	cu.	,970	78,7	11,8	do.	do.	,979	74,5	7,	do.	do.	,033	70,3	2,8	cm.	do.		
23	,022	62,3	1,4	do.	do.	,077	73,5	7,8	do.	do.	,983	80,	11,3	do.	do.	,981	78,3	10,1	n. e.	cu.	,995	73,3	4,4	do.	cis.	,080	71,8	2,0	do.	fog.		
24	,056	61,5	2,3	do.	do.	,124	73,7	7,	do.	do.	,016	79,7	12,2	n.	cis.	,015	78,3	10,8	do.	ci.	,024	75,7	8,2	do.	cl.	,058	70,0	1,3	n. w.	cl.		
25	,058	63,5	2,3	do.	do.	,105	72,	5,1	n. w.	do.	,985	80,5	12,6	n. w.	cl.	,985	79,	11,5	n. w.	cl.	,000	75,7	8,2	do.	do.	,047	71,5	1,0	n. e.	do.		
26	,038	62,	1,3	do.	do.	,097	74,7	6,8	do.	do.	,970	80,5	11,8	do.	cu.	,969	78,7	11,2	do.	do.	,970	75,3	7,4	do.	do.	,008	71,3	1,2	n.	do.		
27	,978	62,7	2,	do.	do.	,050	73,7	6,8	n.	do.	,927	79,5	11,6	n.	do.	,926	77,7	10,5	n.	do.	,927	74,5	6,	do.	do.	,008	72,1	1,5	n. e.	do.		
28	,988	62,3	1,6	do.	ci.	,049	74,	8,	w.	do.	,934	79,5	11,3	w.	cl.	,932	78,3	9,8	w.	do.						,022	72,6	2,5	s. w.	do.		
29	,023	62,	2,8	do.	cl.	,076	73,	5,3	n. w.	do.	,959	81,	9,3	n. w.	do.	,958	79,	8,	n. w.	do.	,965	74,5	3,8	do.	do.	,048	73,2	2,0	cm.	do.		
30	,028	63,	2,3	do.	do.	,078	73,	5,5	cm.	do.	,934	81,5	11,6	n.	do.	,933	80,	10,8	do.	do.	,948	75,3	5,8	do.	do.	,906	70,2	2,2	s. e.	do.		
Mean,	29,997	64,9	2,			,055	75,8	6,9			,943	81,3	11,5			,942	79,8	10,4			,950	76,2	6,6			,014	72,8	4,1			1,46	1,38

Abbreviations. In the column "wind," small letters have been used instead of capitals; *cm.* means *calm.* In the column "aspect of the sky," *cy.* is *cloudy; cl. clear; rn. rain; ci. cirrus; cu. cumulus; cs. cirro-stratus; cus. cumulo-stratus; cc. cirro-cumulus; n. nimbus.*